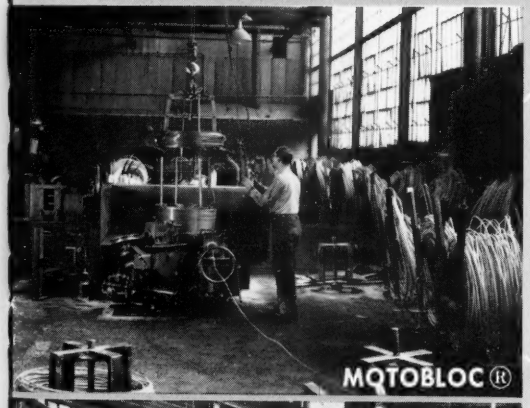
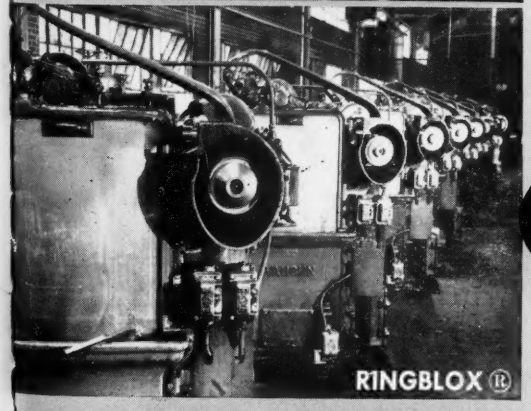
WIRE AND WIRE PRODUCTS

MAY 1953

SPEED

MORE of every essential with VAUGHN





SAFETY

VERSATILITY

LONG-LIFE

THE VAUGHN MACHINERY CO.
CUYAHOGA FALLS, OHIO, U.S.A.
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

"Quick on the Draw"

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

LOOK TO Wean FOR WIRE MACHINERY

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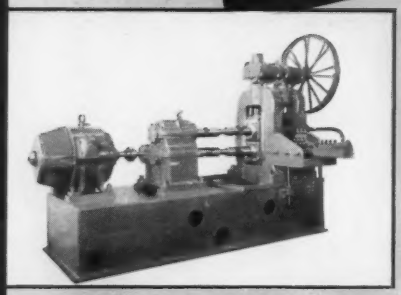
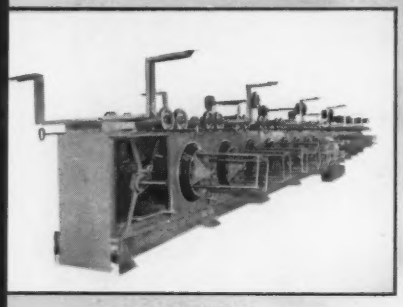
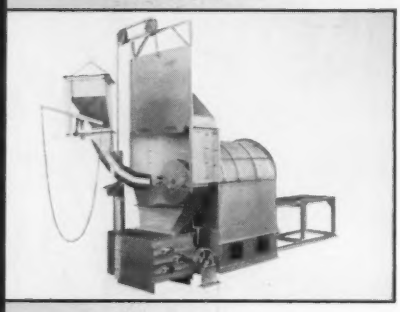


2—Hi Wire Flattening Mill



Wire Galvanizing Take-Up Frame

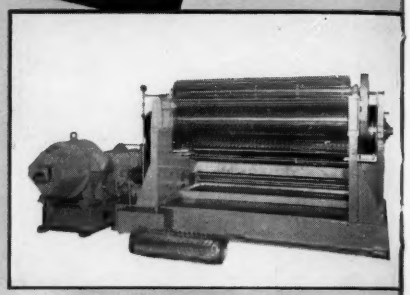


Nail Galvanizing Unit

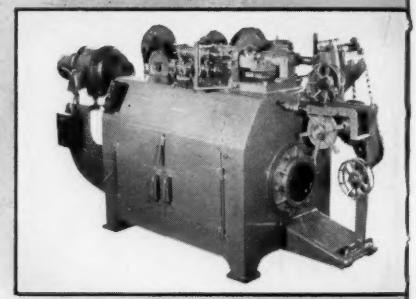
In the past few years tremendous progress has been experienced in the field of wire machinery. Production speeds have been tripled and quadrupled. Product quality has been greatly improved. Machines have been made easier to operate and maintain.

The Wean Equipment Corporation has been a large contributor to this advancement. Wean wire mill specialists have designed, built, and installed wire mill equipment for the leading wire producers the world over. If you make wire you should look to Wean for the best in machinery, service, and facilities.

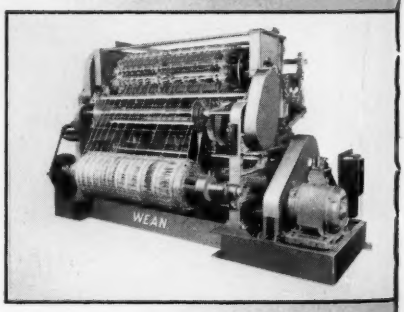
STRIP MACHINERY



Hexagon Netting Machine

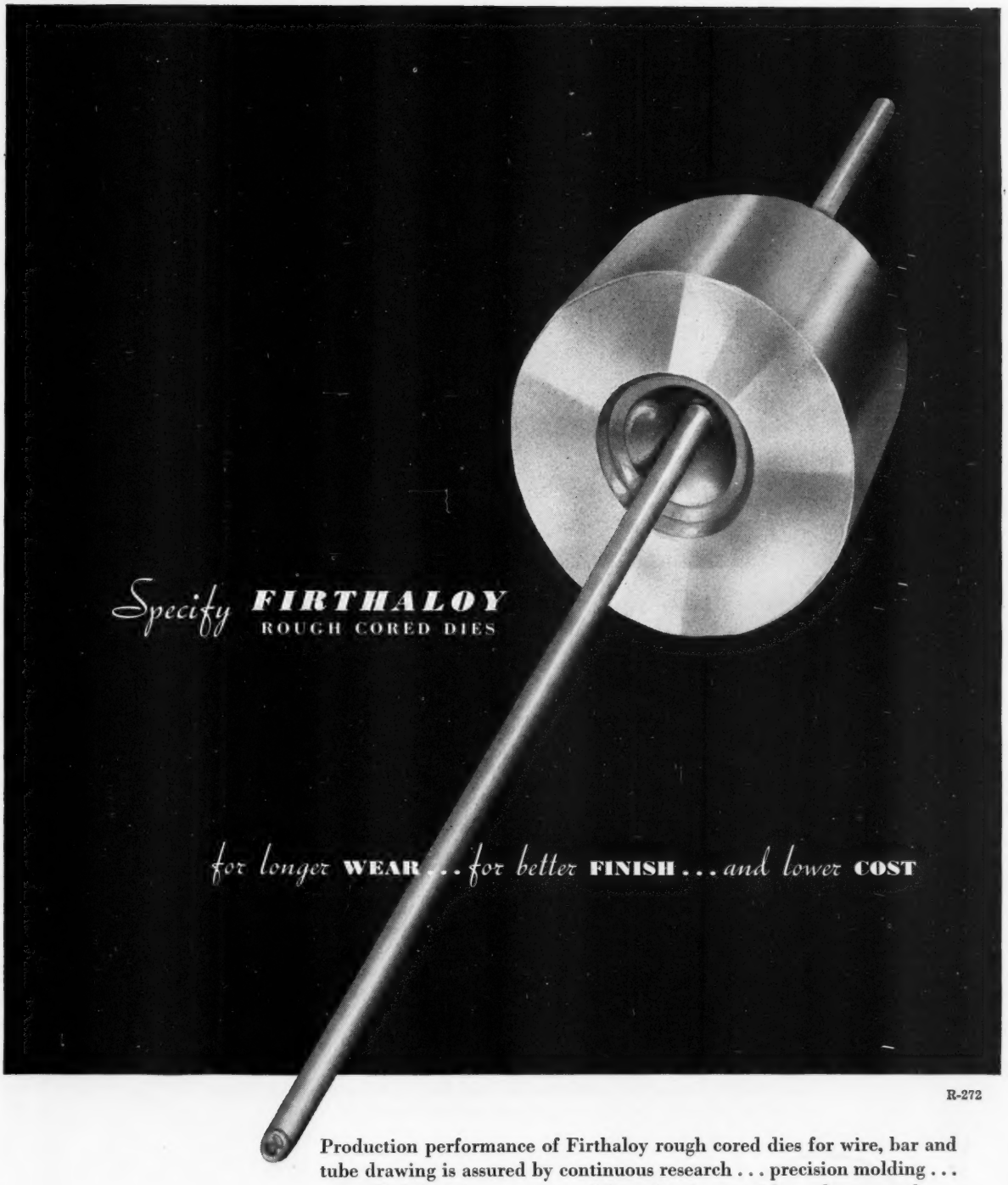


2 or 4—Point Barbed Wire Machine



Hinge — Joint Fence Machine

Wean Equipment Corporation
CLEVELAND, OHIO



R-272

Production performance of Firthaloy rough cored dies for wire, bar and tube drawing is assured by continuous research . . . precision molding . . . controlled sintering . . . a rugged forged casing to withstand extreme drawing pressures . . . and a preformed back relief that lasts the life of the die, minimizing the cost of finishing and recutting.

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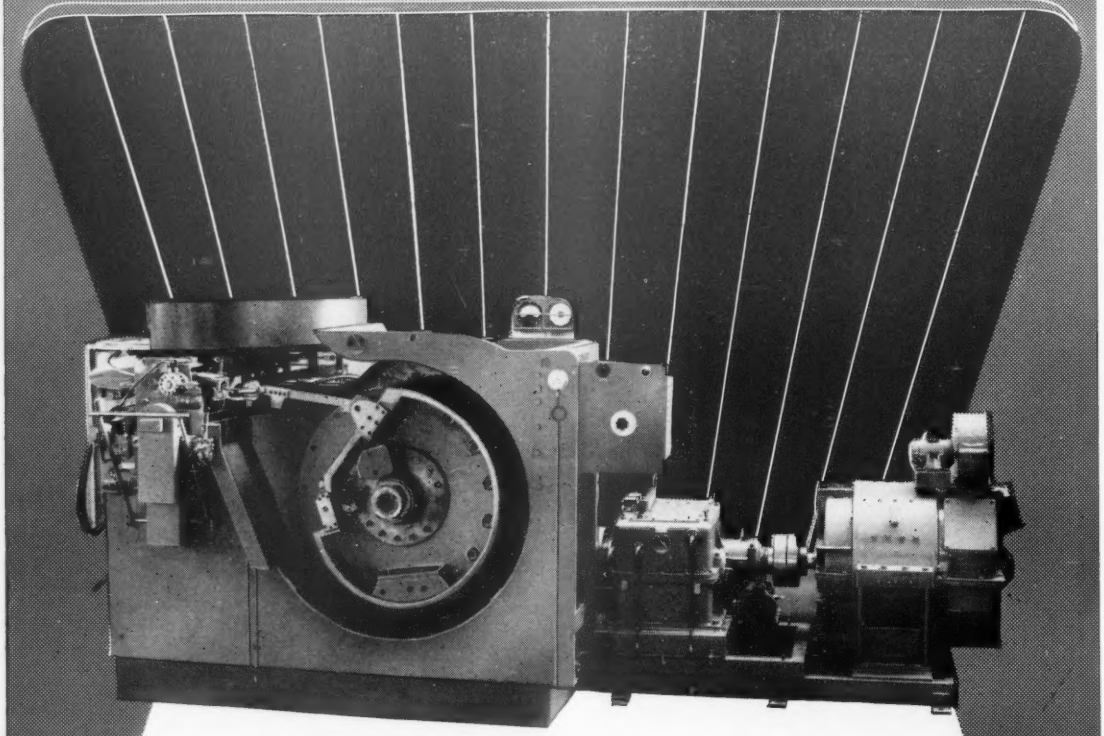
MARSHALL RICHARDS TUBE BLOCKS



We illustrate a large Horizontal Bull Block specially designed and developed and now production tested on both sides of the Atlantic, for drawing non-ferrous tubes.

Every possible refinement to aid high consistent production is incorporated. The machine is the type H.66.T. with a 54" diameter block which draws tube from about 2" o/d maximum using floating plugs. It has a 120 H.P. motor and provides drawing speeds between 150 and 1350 feet per minute. The tube swift is incorporated and the machine is a production unit as soon as it is installed.

A number of standard machines are building in advance of customers order thereby enabling us to offer reasonable deliveries.

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MR 77

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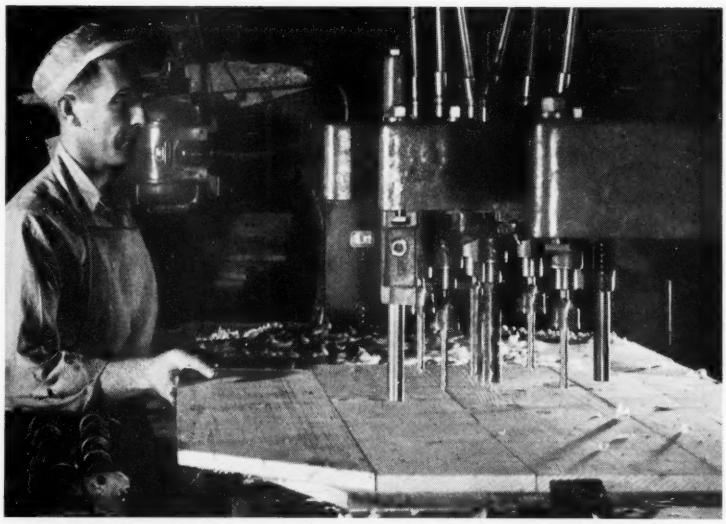
WOOD REELS for CABLE, ROPE and WIRE



Above: BORING MACHINE

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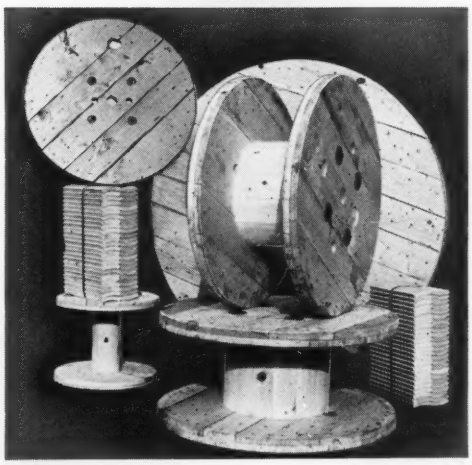
12" to 96" in diameter. Knocked down or assembled. Returnable or non-returnable. Wood heads for steel drums.

REELS made by **BRIDGE** are of precision construction produced for each customer to his own specifications. They are rugged and will withstand severe handling, yet they cost you no more than ordinary reels. Our modern plant, with much equipment specially built for us, together with our straight-line production methods, assure you of the best at the lowest cost.



PLUS A SPEEDY SHIPPING SERVICE

Bridge delivers by truck to your door within a radius of 200 miles from the plant. Fast freight will bring you Bridge reels in 5 days or less east of the Mississippi.

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HAZARDVILLE, CONN.
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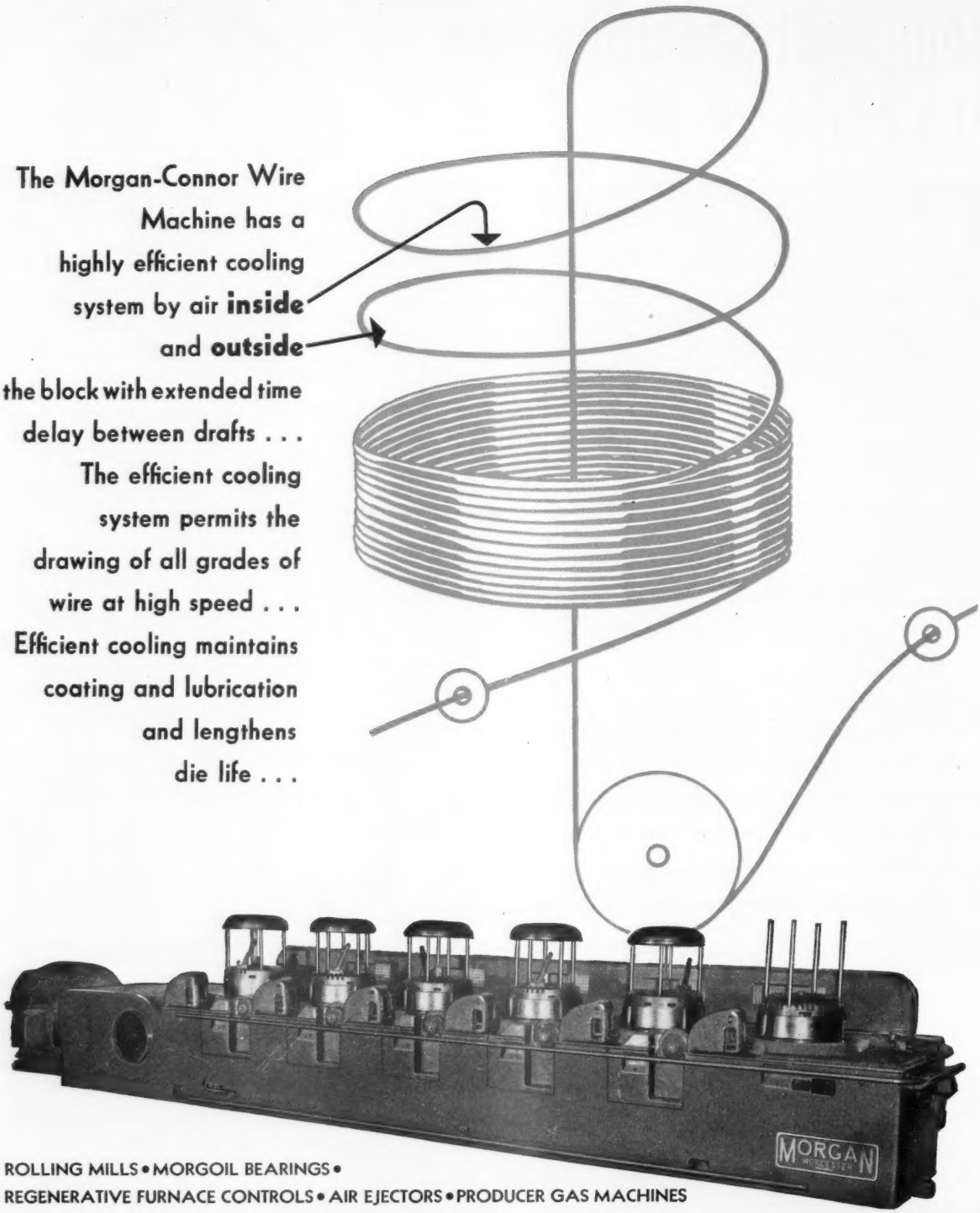
Because of the unprecedented demand for Bridge Reels, we are not at present able to give our usual prompt service to all customers. We are taking steps to remedy this situation and ask your kind indulgence meanwhile. Thank you for your patience.

Let us quote on your reel needs. Send your specifications. Better yet, visit our plant and see how and why our reels are made so well at so low a cost.

The Morgan-Connor Wire Machine has a highly efficient cooling system by air **inside** and **outside** the block with extended time delay between drafts . . . The efficient cooling system permits the drawing of all grades of wire at high speed . . . Efficient cooling maintains coating and lubrication and lengthens die life . . .



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WIRE MACHINES

WM 64

MORGAN CONSTRUCTION COMPANY • WORCESTER, MASSACHUSETTS

WIRE AND WIRE PRODUCTS*

Reg. U. S. Pat. Off.

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 28 May, 1953 No. 5

Designated as Official Publication By The Wire Association

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- ✓ Annealing cycles accomplished in minutes rather than in hours
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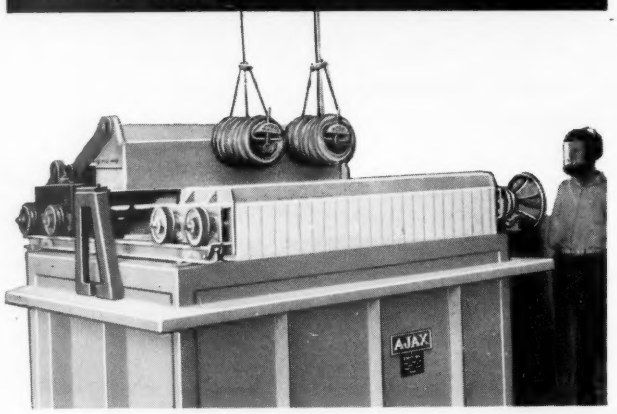

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cost no more than conventional wire-drawing compounds

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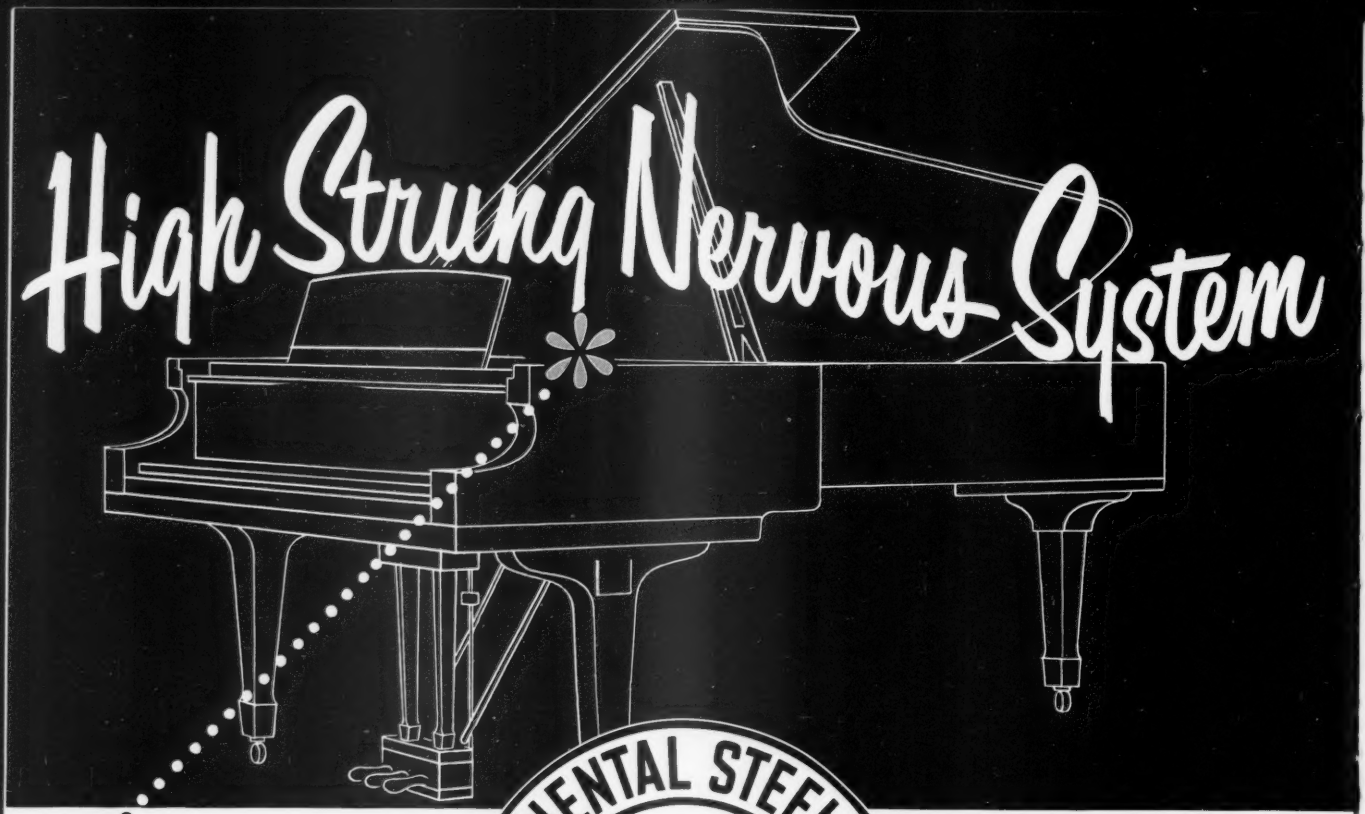

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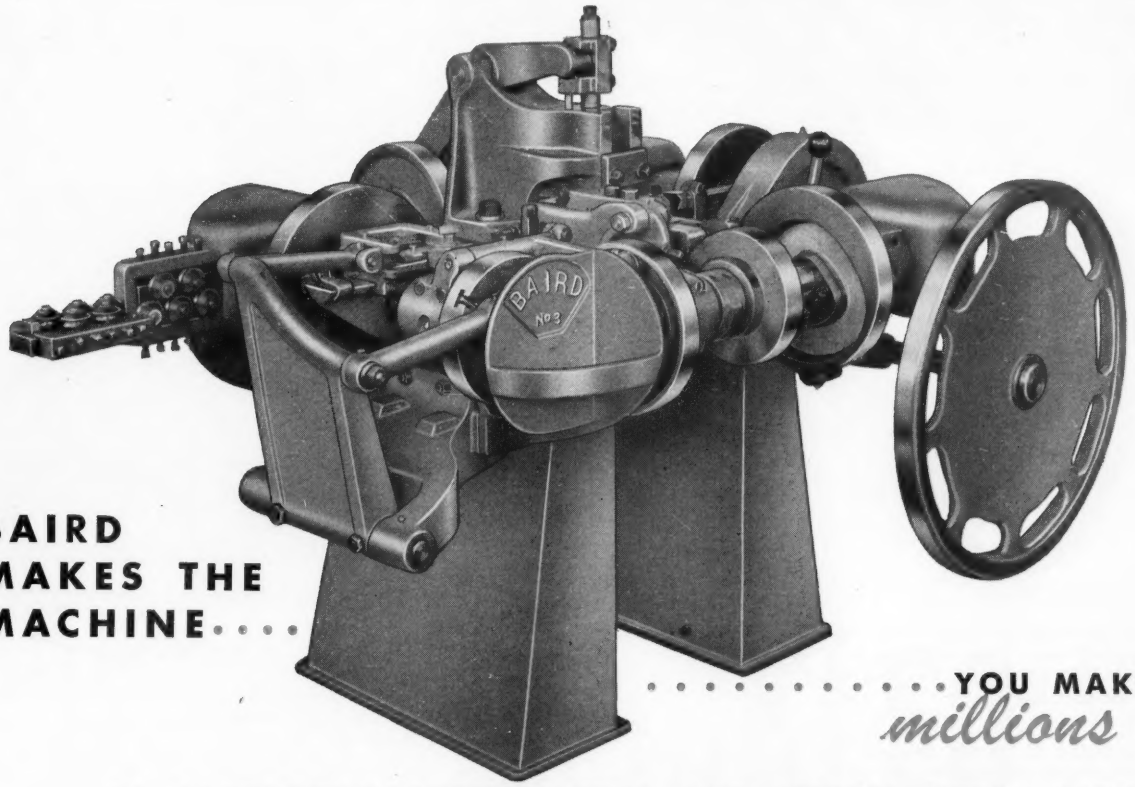

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3BA53

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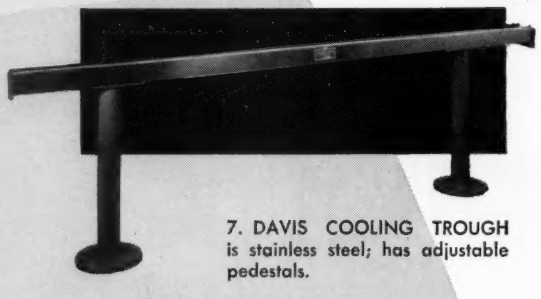

7. DAVIS COOLING TROUGH is stainless steel; has adjustable pedestals.

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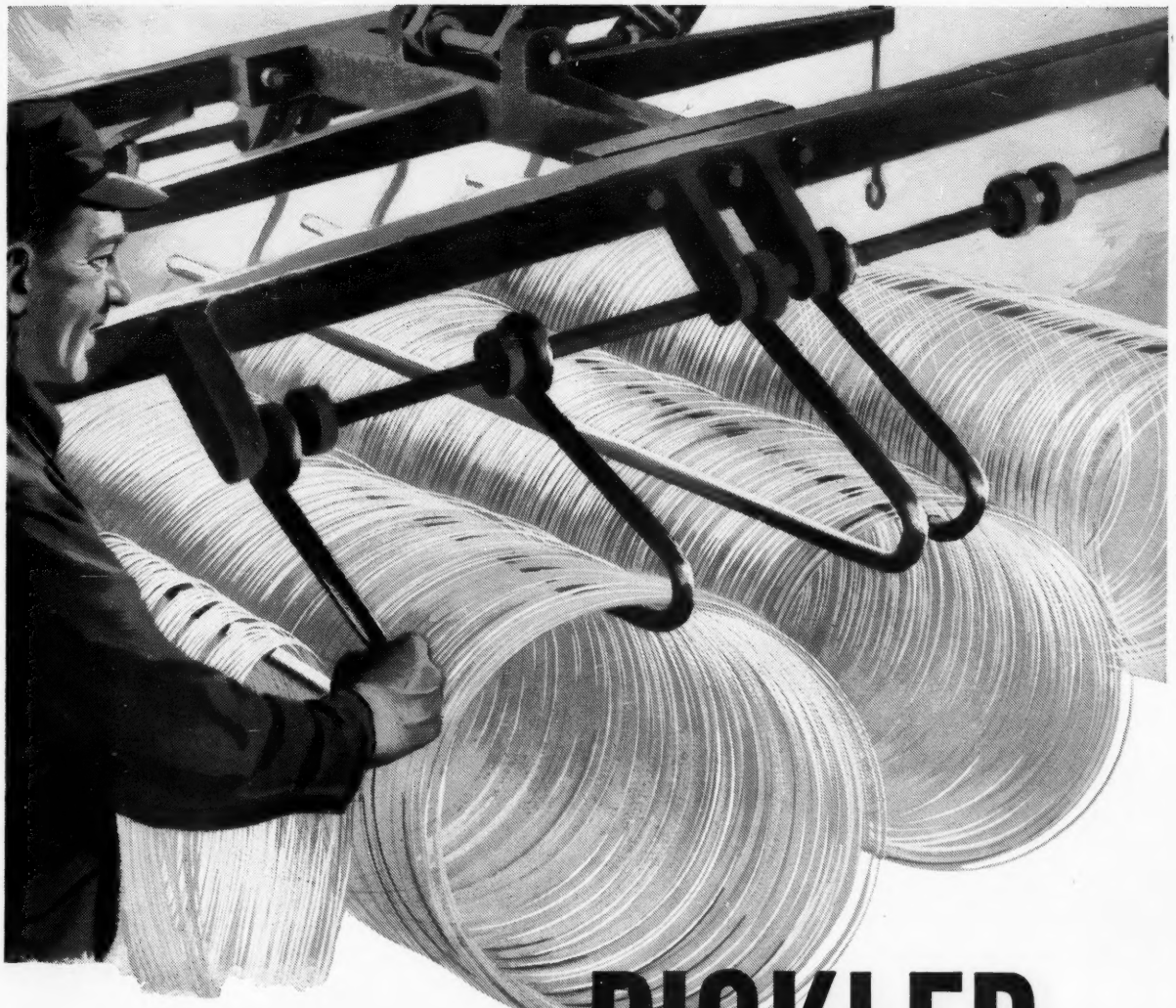

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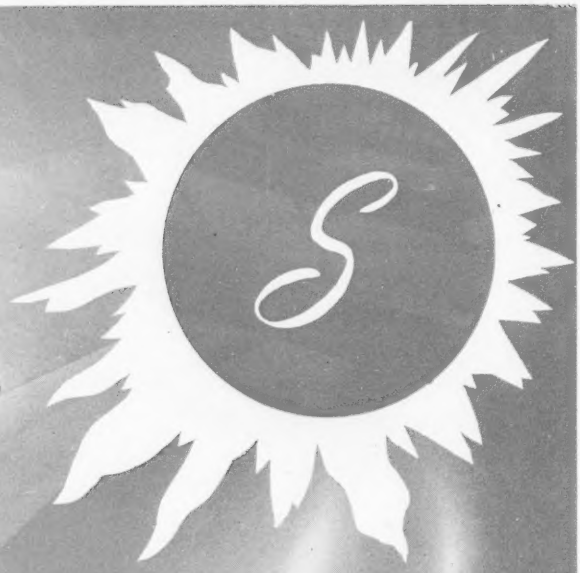
STANDARD'S BRIGHT WIRE COMPOUNDS



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Protects the wire from oxidizing for considerably longer periods than conventional compounds. Preserves the bright finish on copper coated or liquor finished wire and prevents tarnish on copper or brass wire for longer periods of time.

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A. Small amounts needed. Due to the natural affinity for metal small amounts of this compound are needed. Draws high carbon wire at high speeds with a fat content as low as .30 per cent, because of this affinity for metal and the natural wetting-out characteristics.

B. Low pH value.

C. Protects steel wire from rusting and copper coated and liquor finished steel wire from oxidizing. Protects copper and brass wire from tarnishing.

D. A clean compound. Keeps equipment clean and drawn wire has a clean finish.

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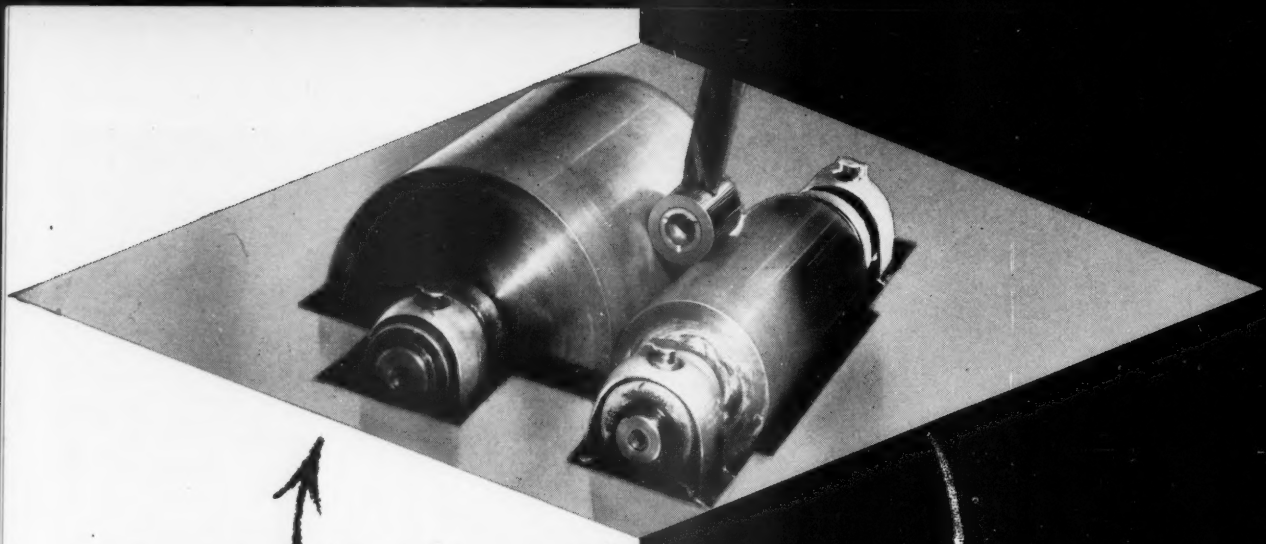

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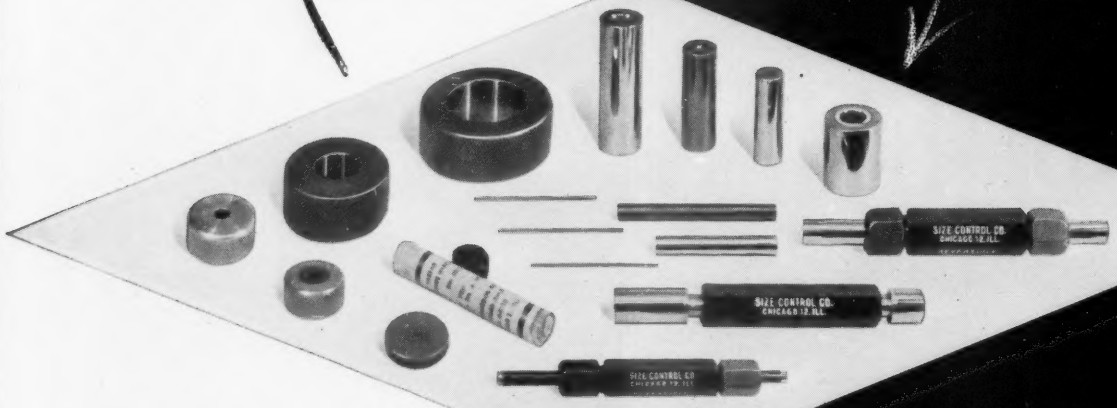

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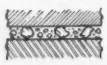

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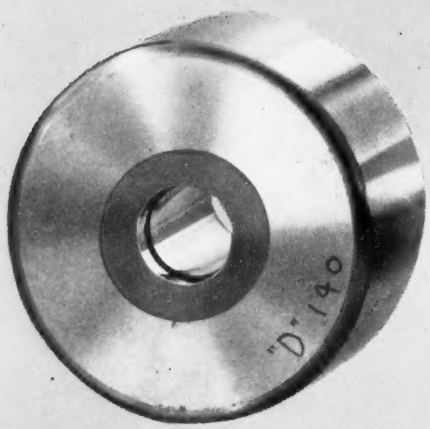

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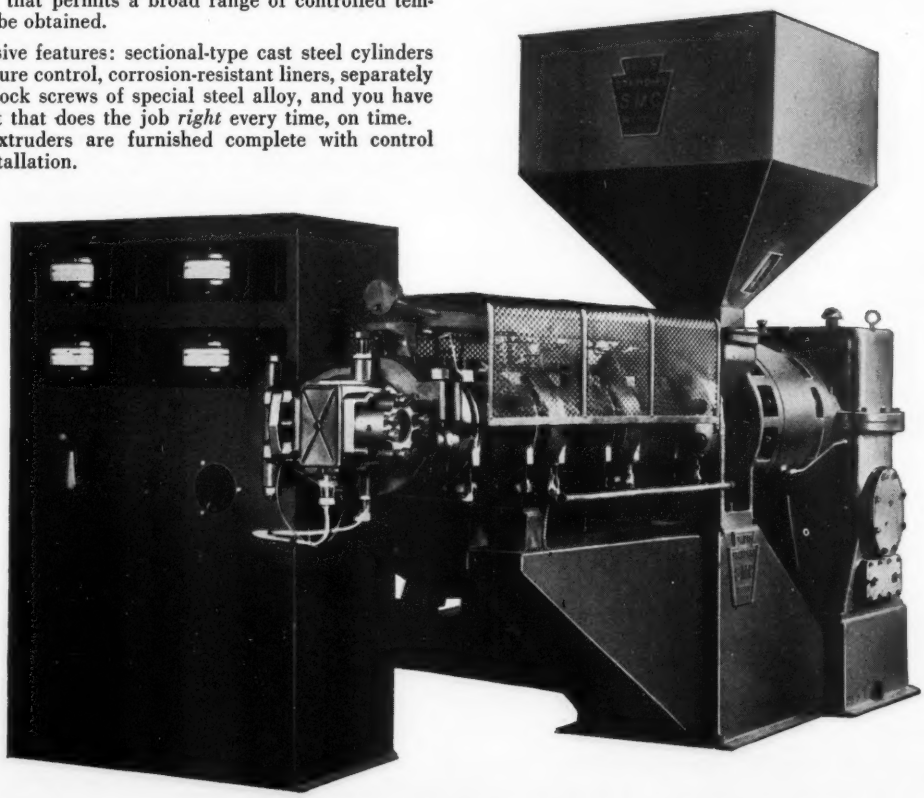

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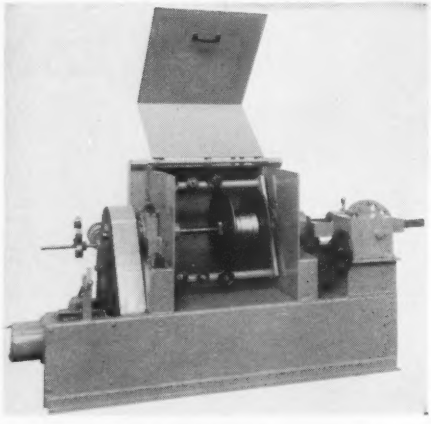

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Reel Capacity: 350 pounds.

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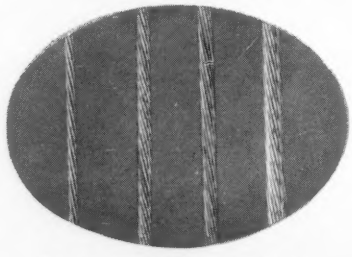
The illustration at the right is an example of 7, 10, 16, & 26 strands of #30 tinned copper. While the 7 strand is a concentric lay, the others theoretically are not; yet they are formed with perfect concentricity on the new Cook Buncher.



7/30 10/30 16/30 26/30

With this Cook Buncher, the wire industry has an extremely versatile machine. When used for straight bunch stranding the Cook Buncher produces bunched wire with such concentricity that the leader die used on an extruder would have as small minimum of clearance as used for solid wire.

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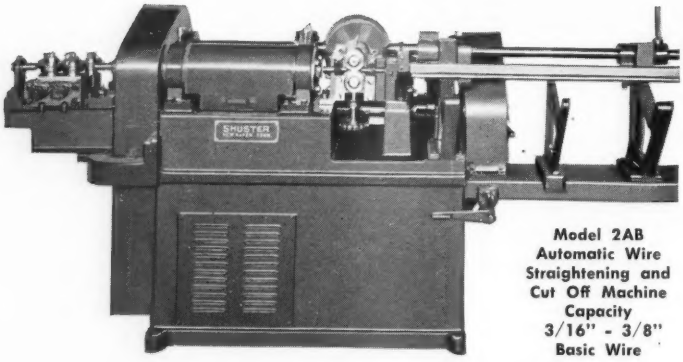
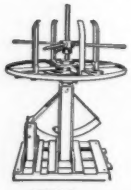
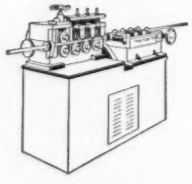


Model 2AB Automatic Wire Straightening and Cut Off Machine Capacity 3/16" - 3/8" Basic Wire



REELS



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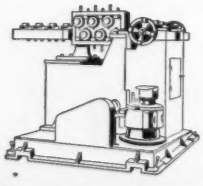

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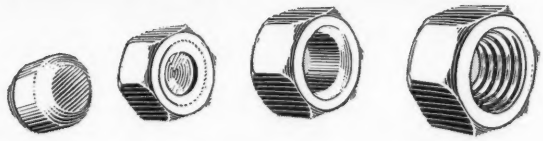

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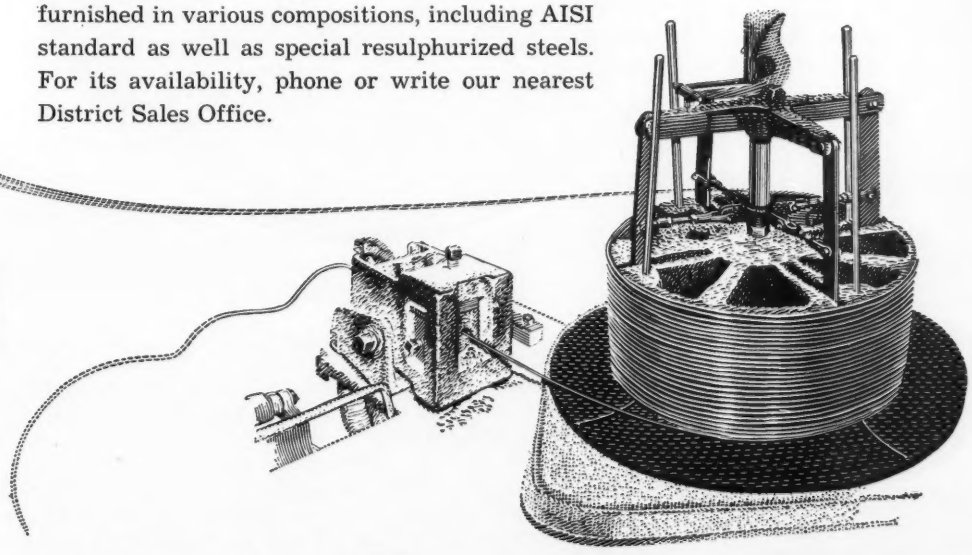
Every step of its manufacture is carefully controlled—from the melting furnaces to the final drawing operation on the wire machines. Each coil of wire is subjected to close inspection and rigid tests with modern electrical testing apparatus.

Youngstown's Scrapless Nut Quality Wire is furnished in various compositions, including AISI standard as well as special resulphurized steels. For its availability, phone or write our nearest District Sales Office.



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The Wire Outlook

It would be nice to be able to feel that Moscow's sudden friendliness represented an honest change of heart, with Stalin gone, but there is every reason to believe that its objectives have not changed. The soothing new attitude is aimed at weakening the anti-communist alliance in Western Europe, a strengthening of Russia's hold on Eastern Europe, toward gaining further influence in Asia and to gain time during the struggle for power within the Kremlin.

Not to be denied is the unsettling influence that the prospect of peace in Korea has had on businessmen. Our economy has long been geared to war production. The stock market reflected this uneasiness by plunging sharply. But Moscow's peace gestures still have to be tested and Washington is hardly likely to be unprepared for the future, peace or no peace. A truce, or even peace, might lead to a temporary softening of business, but there will be no crash.

Business activity, in fact, is not only high, but still inching upward, and its momentum will make 1953 an excellent year, perhaps better than 1952. The first quarter is said to have been the best in our history. As a matter of record, cuts in government spending are proving more difficult than the Administration had anticipated—everybody wants the other fellow's extravagances reduced. There is a lot of pork barrel politics in this too. Most Congressmen want to do something for the folks back home.

A downward pressure on prices has been developing, due to increasing competition, which will accelerate as the year wears on. Production is high and defense is taking only about 15% of the total output. Purchasing power is also high. From 1950 to 1951 personal expenditures increased by 14 billions, accounted for by wage and price increases. Real production had not changed. In 1952 personal spending went up another 8 billions, only half of which was attributed to price rises.

If and when the armament program tapers off, it will become increasingly necessary to cut both taxes and Federal expenses. Only by upping the purchasing power of the people can the goods produced by industry be absorbed. Such buying leads to high living standards and a high degree of prosperity, while over-heavy national and local government budgets lead to socialism and the destruction of those incentives that keep business progressive and solvent. Witness England's almost incurable plight.

There are many signs that more purchasing power is needed. Houses are being built at the rate of 1.3 million units—above the probable present demand; autos are selling well now, but the production of 7 million this year may be many more than can be absorbed; TVs are being turned out at the rate of 9 million a year—can the market buy them? Price cutting and perhaps production cut-backs may be seen before the year closes.

Domestic copper prices seem at last to have stabilized at 30 cents. It is high, but better than having prices all over the lot. Foreign copper still costs from 33 to 36.5 cents.

Demand for most wire is heavy, especially for upholstery springs. Cold heading wire is moving well and cold headers appear to be booked solidly for two months in advance. Their deliveries from the mills have improved. High carbon spring and welding wire demand is exceeding output. Nails are plentiful and most wire products are moving satisfactorily. The weak spots are plain galvanized wire, carbon specialties and music wire, on which output is exceeding demand for the time being.

There is no easy way out of the mess inherited by the Eisenhower administration, but we can all rest assured that there will be no let-up in efforts to re-establish order out of chaos, and eventually build a foundation for a sound, healthy economy.

—from the Editor's Desk

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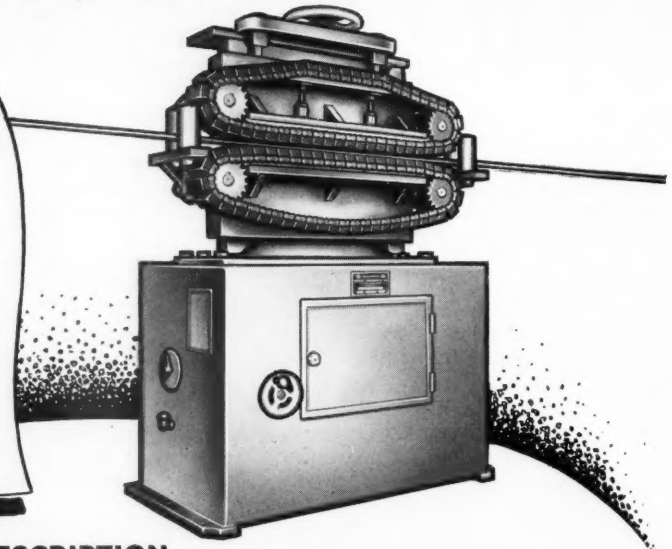

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Horizontal pull is imparted to the cable as it passes between two tractor treads consisting of a series of individual blocks - - moulded of tough, resilient, synthetic tire-stock material.

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Vol. 28 MAY, 1953 No. 5

Tangential Forces in Wire Ropes

by Federico Hruska H.
Madeco
Santiago, Chile

This is the third of a series of articles prepared by the author on wire rope. The first was concerned with the calculation of stresses in rope, the second with radial forces therein and this one with tangential forces.

When we put a load on a strand we provoke tensile stresses in the individual wires. These wires form an angle, the lay angle with the axis of the strand, and therefore there must exist simultaneously also other forces in the strand. The cross-section of a strand in Fig. 1 shows the radial force R emanating from the curved form of the wire and the tangential force T coming from its inclination. The two forces form together an angle of 90° and there is no direct relation between them to be found in the picture.

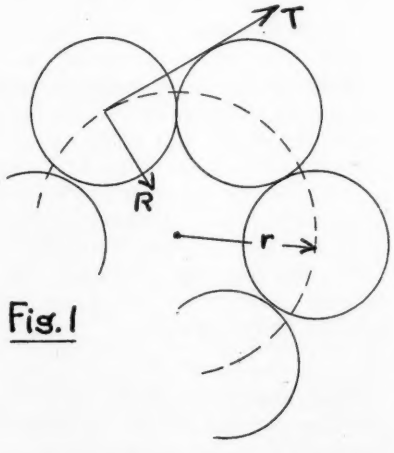
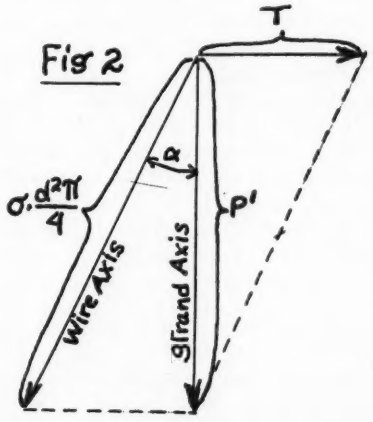


Fig. 1

Fig. 2 shows us the relation between the part of the load P^1, corresponding to the considered wire, the tension provoked in the wire $\sigma \frac{d^2\pi}{4}$ and the tangential force T which completes the forces-parallelogram.



The tangential force T will be therefore:

$$T = \sigma \frac{\pi d^2}{4} \sin \alpha \qquad (1)$$

The tangential forces of the individual wires will provoke a moment around the axis of the strand. This will be T.r. according to Figure 1. The total moment of a layer of wire will then be:

$$M = f \cdot \sigma \cdot r \sin \alpha \qquad (2)$$

where f stands for the total section of all wires of the considered layer.

★ ★ ★

The moment will try to make the strand revolve around its axis. When both ends are firmly fastened, then the driving moment will be neutralized by the moments of reaction provoked at the ends. But when on one or both ends are freehanging loads, then the strand (or rope) can rotate. The speed of rotation, the number of revolutions to standstill, etc., will be different for different ropes and loads.

★ ★ ★

The limited purpose of this article is to show how we can calculate the driving moments under known conditions and the changes in the distribution of stresses in ropes caused by rotation. The problem how to calculate the number of revolutions made by a strand or rope to standstill, has already been solved, but cannot be treated in this article for lack of space. For the same reason the

influence of a given rotation on the real breaking strength of a strand or rope cannot be discussed.

★ ★ ★

It is only in the form of a moment that the tangential forces act. In the following, tangential forces by themselves will not be mentioned again and only the moment produced by them will be discussed.

★ ★ ★

In the further discussion the following list of symbols used in the treatment of the problem is necessary:

α = lay angle of wires in strand (positive when right lay)
β = lay angle of strands in rope (positive when right lay)
r = radius of pitch diameter of a layer of wires in a strand (see fig. 1)
R = radius of pitch diameter of a layer of strands in a rope (see fig. 3)
f = total section of wires with the same geometrical conditions in strand or rope
ψ = angle of rotation per length-unit (positive when rotation opens a right lay strand and negative when closing)
σ = stress produced in wire by a load.
ρ = stress produced in wire through rotation
S = total stress produced in wire core
d = wire diameter
n = number of wires in one layer of a strand

suffixes used will be explained in the text.

★ ★ ★

Formula 2 gave us the moment produced by a layer of wires in a strand. This same layer will produce a further moment, when the strands are united in a rope. In Fig. 3 the moments are symbolized. The direction of the moments may be the same (Lang Lay) or opposite (Regular Lay) as shown in the picture.

★ ★ ★

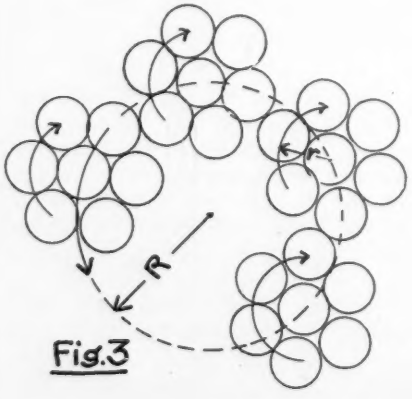


Fig.3

The total moment produced by one layer of a strand in a rope will be

$$M = n\frac{\pi d^2}{4}\sigma \cdot r \sin\alpha + n\frac{\pi d^2}{4}\cdot \sigma R \sin\beta = f\sigma(r\sin\alpha + R\sin\beta)$$

★ ★ ★

Let us remember that f is the section of the wires with the same geometrical conditions in the rope, that is, all wires with the same values of r, R, α and β. The total moment originated in a rope will be the sum of all partial moments.

$$M = \sum f\sigma(r\sin\alpha + R\sin\beta) \quad (3)$$

α **and** β may be positive or negative as the sine of a negative angle is also negative, the moments may partly or wholly compensate themselves. This will be the case for inst. in a wire rope 6 x 7, Regular lay, where β will be positive (right rope lay) and α negative (left strand lay).

★ ★ ★

The use of this formula is not difficult, but somewhat lengthy, especially in the case of complicated ropes with several layers of wires in strand or strands in rope. First must be determined the stress for every group of wires with the same geometrical conditions. This can be made by the method explained in the first article of the author, (Wire and Wire Products, Sept, 1951—Calculation of Stresses in Wire Ropes). Once σ is known for every group, it is easy to compute the moment for every group, as all other necessary data, that is, f, r, R, α, β, are given by the construction of the rope.

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Let us take the following example: a 6 strand rope, right Regular lay, each strand with one core wire of .105" and 6 wires of .10", rope lay 5-7/8", strand lay 3", load 10,000 lbs, no rotation permitted. The lay lengths signify that

$\beta = +17°40'$ and $\alpha = -12°10'$.
r will be .1025" and $R \simeq .325$"

★ ★ ★

There are in this simple rope two groups of wires with identical geometrical conditions within each group, namely

1. the 36 outer wires with $\alpha = -12°\ 10'$, $\beta = +\ 17°\ 40'$ r = .1025" and R = .325"
2. The 6 core wires with $\beta = +\ 17°\ 40'$ and R = .325" (α and r are zero for the core wires)

★ ★ ★

Formula 3 will consist in this case of two parts as can be seen.

$$M = 6\frac{.105^2\pi}{4}\sigma_c \times .325 \sin 17°40' \text{ for core wires, and}$$
$$= 36\frac{.10^2\pi}{4}\sigma_1 (.325 \sin 17°40' - .1025 \sin 12°10') \text{ outer wires}$$

(σ_c is the stress in the core wires and σ_1 that of the first layer)

★ ★ ★

With formula 11 of the first article of the author the stress σ_c in the core wires can be calculated

$$P = 6\sigma_c \cos\beta (f_c + f_1 \cos^3\alpha + f_2 \cos^3\alpha_2 \cdots)$$

and entering the data of our special case we get

$$10{,}000 = 6\sigma_c \cos 17°10' \left(\frac{.105^2\pi}{4} + 6\frac{.10^2\pi}{4}\cos^3 12°10'\right)$$

from this we get σ_c = 33,200 psi.

★ ★ ★

The stress in the outer wires σ_1, can be calculated with the aid of form 3 of the mentioned article.

$$\sigma_1 = \sigma_c \cos^2\alpha_1 = 33{,}200 \cos^2 12°16'$$
$$= 31{,}400 \text{ psi}$$

★ ★ ★

With σ_c and σ_1 known we can finish the calculation of the moment M, which will come to 860 inch-lbs. The same rope in Lang lay, where the wires in the strand have right lay, (α positive) the moment will amount to approx. 1250 inch-lbs. As expected, the driving moment of the Lang lay rope is much greater.

★ ★ ★

Theoretically, it should then be possible to make a wire rope where the total moment becomes zero or, in other words, a rope which should not rotate when stressed

by a free-hanging load. But in practice this task is not easy.

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Formula 3 for the moment shows us the difficulties. These consist mainly in the much greater magnitude of "R.sin β" against "r.sin α". Even without interpretation of the formula it is quite evident that the moment exerted by the strands is much greater than that of the wires in the strands. That is also the reason why 6 strand ropes never can be made non-rotating, except by using combinations of lay angles completely outside of any practical range. The same difficulties persist in a minor degree in ropes made up by two or three layers of strands. In a rope consisting of an outer rope of 12 strands and an inner rope of 6 strands, the section (f) and the radius R, of the outer layer of strands, are each approx. double of the corresponding value of the inner rope. That means, that the influence of the outer rope in the moment is four times that of the inner rope. The influence of the moment exerted by the wires in each strand (always cabled in such ropes in the same direction as the inner rope) helps somewhat, but is never sufficient. Such "non rotating" ropes develop under a free-hanging rope a moment which induces the rope to turn around its axis, or, in other words, they are not really non-rotating. What makes these ropes so useful in practice is the fact that with a small twist (small angle of rotation ψ), the rope stops and comes to equilibrium. Now, why and how this happens, while ordinary 6 strand ropes make many revolutions before stopping?

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There are two main causes which make a rope or strand stop when rotating under a free-hanging load.

★ ★ ★

The first reason is that the individual wires of the rope are deformed through rotation, the deformation being mainly twisting. But there is also a small amount of bending through the change of the original helix form of the wires. Through this deformation, torsion and bending stresses are built up in the wires which act as a moment in the opposite direction of the driving moment in the rope. With continued rotation the counteracting moment of the deformed wires increases and will finally stop rotation when it will equal the decreasing driving moment. That is the reason why even a 6 wire strand with fibre core will stop before becoming a bundle of parallel wires.

★ ★ ★

The second reason in that rotation changes the stresses in the wires and hereby alters the driving moment. These changes are drastic in ropes with layers of wires or strands cabled in opposite direction as will be discussed later in detail. This is exactly, what happens in "non-rotating" ropes where the driving moment rapidly disappears under a free-hanging load.

★ ★ ★

The interesting problem of the changes in the distribution of stresses in a rope by rotation has been treated in a very thorough way by Mr. F. Dreher in an extensive article in the "Wasserwirtschaft" in 1934 (#). Unfortunately, the author made a great mistake by partly basing his calculation on a wrong relation between the load and the stress produced in the wires. Mr. Dreher considers that

$$\sigma \frac{d^2\pi}{4} = P \cos\alpha$$

while correctly is

$$\sigma \frac{d^2\pi}{4} = \frac{P}{\cos\alpha}$$

(Fig. 2). In spite of this error, which affects the final results in a few units of percent, the work of Mr. Dreher is of very great value. The following treatment of the problems is based on its principles on the work of Mr. Dreher, though purpose, method and, of course, final results are somewhat different.

★ ★ ★

The changes in stresses mentioned above, are caused by the fact that the lay angles are altered through rotation. Though the alteration is very small when we remain within practical limits, it is sufficient to produce an important lengthening (or shortening) of the strand, in the cases where the construction of the strand permits it.

★ ★ ★

Such a case would be, for intance, a strand with one layer of wires and fibre core. But in strand with more layers, each of them will ask for another lengthening of the strand as we shall see later, while the core wire, if such would be used, would not change at all its length through rotation. It is evident, that there must arise differential stresses which will alter the original distribution of stresses existing before rotation. It is important to realize that we must consider only this impeded variation of length while the change in the lay angle itself is practically without influence. An angle of rotation of 1°/inch, corresponding to one full revolution in 30 feet of strand, will alter any customary lay angle only in fractions of one degree. We can therefore in formulae 1 to 3 and in all the others we shall develop later, assume that the angles α and β will be the same before and after rotation, remaining naturally within practical limits of ψ. This simplifies greatly our task of calculating the changes in the stresses, which problem can be solved in the following way:

In Fig. 4, the drawn out helix symbolizes the position of a wire in a strand before rotation and the dotted one after that the strand has been twisted around its axis with an angle of rotation per length unit ψ.

★ ★ ★

Considering one lay length c, the total movement of the end of the wire will be r. ψ c. ψ is in all practical cases very small and we may assume that the angles at the base of the triangle formed by the wire axis before and after rotation, as shown in Fig. 5, will be very near 90°. Then the necessary lengthening of the lay-length

(#) **Wasserwirtschaft Vol. 27 No. 7-8 "A contribution to the theory of tortion and distribution of stresses in strands and ropes."**

(core) would be

$$\Delta_c = \varphi c r \operatorname{tg}\alpha$$

This lengthening of the core can only be obtained through an increase of the stress in it. Assuming that we stay within the validity of Hooke's law, we can put

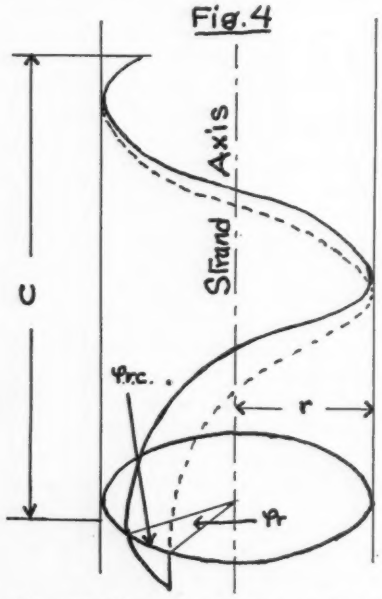
$$\Delta_c = \frac{\varrho c}{E} = \varphi c r \operatorname{tg}\alpha$$

the change in stress in the core wire caused by the rotation will be:

$$\varrho = \varphi E r \operatorname{tg}\alpha \qquad (5)$$

It will be realized that ρ is the stress produced through rotation in the core wire of a strand only submitted to twisting, that is, without a load producing tension stresses, in a case of mere theoretic interest.

Fig. 4



In practice the strand will be always under the action of a load, producing tension stresses, which together with ρ will form the total stress. The stress in any outer wire σ_e is related to the stress produced by the load in the core wire σ_c by the formula

$$\sigma_e = \sigma_c \cos^2\alpha$$

which already has been used in the calculation of the first example in this article. The total combined stress in the core wire will be then

$$S = \sigma_c + \varrho = \frac{\sigma_e}{\cos^2\alpha} + \varphi E r \operatorname{tg}\alpha \qquad (6)$$

Transforming formula 6, we finally get the stress in any outer wire of the strand

$$\sigma'_e = \cos^2\alpha\,(S - \varphi E r \operatorname{tg}\alpha \qquad (7)$$

This expression is the clue for the understanding of what happens in a stressed strand when it is rotated. The first part S. $\cos^2\alpha$ is the known relation between stress in core and that in the other wires when rotation is made impossible. The second part "$\cos^2\alpha\ \varphi E r \operatorname{tg}\alpha$" shows how this stress in the outer wire is affected by the rotation.

★ ★ ★

ψ **can be** positive or negative because the formula does not only cover the case of a free-hanging load, but any lefthand or righthand twist we would wish to impose on the rope. There is, of course, a limit for ψ, as the formula is based on the validity of Hooke's law and a drastic change in the distribution of stresses will often lead to an extremely high stress in some wires, which may even reach the UTS. Another limitation is given through the fact that the formula might give in some cases also negative stresses (compressive stresses) which cannot, for instance, occur in the outer wires of the strand. These wires instead of accepting compression will simply loosen.

★ ★ ★

Once the formula for the strand is understood, there is no difficulty in principle for applying the same method for the rope, though things become more complicated. The change in the core length Cr for the rope (corresponding to formula 4) will be

$$\Delta_{cr} = \varphi c_s r \operatorname{tg}\alpha \cos\beta + \varphi c_r \cdot R \operatorname{tg}\beta \qquad (8)$$

as the length of the core in the strand Cs is Cr/cosβ, formula 8 becomes simply

$$\Delta_{cr} = \varphi c_r (r \operatorname{tg}\alpha + R \operatorname{tg}\beta) \qquad (9)$$

Performing the same transformation as made with formula 4, we obtain the alteration of stress produced in the core wire of the rope by rotation

$$\varrho = \varphi E (r \operatorname{tg}\alpha + R \operatorname{tg}\beta) \qquad (10)$$

Wire ropes with fibre core have naturally no core wire, but this is of no importance, as the formula indicates the change of stress, also of an imaginary core wire.

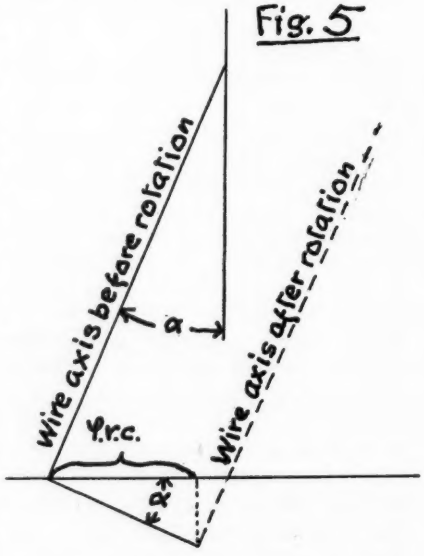
★ ★ ★

Going on with the transformation which led in the case of the strand to formula 6 and 7, we obtain the total stress in any wire of the rope

$$\sigma' = \cos^2\alpha \cos^2\beta\,[S - \varphi E r \operatorname{tg}\alpha + R \operatorname{tg}\beta)] \qquad (11)$$

This is formula 7 in its more ample shape for the rope. In fact, with $\beta = \Theta$, which would correspond to a strand, formula 11 becomes 7 again.

Fig. 5



It will be realized that the first part, namely, "$S \cos^2\alpha \cos^2\beta$"

is the stress produced by the load and the second, that is

"$\cos^2\alpha \cos^2\beta\ \varphi E (r \operatorname{tg}\alpha + R \operatorname{tg}\beta)$"

is originated by rotation.

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We are now in a position to calculate the stress in any wire once

we know the stress S in the (imaginary) core wire of the rope. If rotation is impeded ($\psi = \ominus$), the stresses will depend only on α and β. It is therefore possible to make ropes where all wires are stressed equally by making α and β for all wires the same. (That would by the way involve the non-use of any core wire.) But if the rope rotates, all stresses will be changed, whatever lay angle should be used. Only ropes consisting of one layer of strands, each of which consisting of one layer of wires (both rope and strand with fibre core) will not change the stresses, because not only α and β, but also r and R are the same for all wires. It is interesting to note that formula 11, apparently indicates also for this special case a change, but by checking the stresses before and after rotation with the method to be explained in the next chapter, we would find that they were not altered, because the change in S compensates the expression

$$\text{“ } \cos^2\alpha \cos^2\beta \; \psi E (r \operatorname{tg}\alpha + R \operatorname{tg}\beta) \text{“}$$

This is a confirmation of the developed formulae.

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For the calculation of the absolute value of stresses we must introduce, of course, the load applied to the rope.

$$P = \Sigma f \sigma \cos\alpha \cos\beta \qquad (12)$$

In a rope with impeded rotation $\sigma = \sigma_c \cos^2\alpha \cos^2\beta$ and so we can write

$$P = \Sigma f \sigma_c \cos^3\alpha \cos^3\beta \qquad (13)$$

★ ★ ★

This formula could have been used in the first example of this article and will be very useful for the calculation of driving moments of more complicated ropes than those with 6 strands.

★ ★ ★

Introducing into formula 12 σ according to formula 11 we get:

$$P = \Sigma f \cos^3\alpha \cos^3\beta \left[S - \psi E (r \operatorname{tg}\alpha + R \operatorname{tg}\beta)\right] \qquad (14)$$

Both in formulae 13 and 14 there is only one unknown, that is, the stress in the core (σ_c or S), which can therefore be determined. While the stress in the (imaginary) core wire of the rope will be comparatively easy to determine, for the rope with impeded rotation, (σ_c formula 13) that same operation for the twisted rope (S formula 14) will be usually a time consuming job. But once determined, it will not be difficult to compute the stresses in each group of wires by making use of formula 7.

★ ★ ★

The following two examples will illustrate the magnitude of the changes produced.

One will be the rope 6 x 7 x .10", for which we calculated already the driving moment in the beginning of the article. We now shall assume one full revolution of the rope in 30', in the direction of opening the right lay rope, that is, $\psi = +1°$/inch. The computation of S will, with aid of formula 14, assuming Regular lay, be the following:

$$10{,}000 = 6 \frac{.105^2\pi}{4} \cos^3 14°40' \left[S - .0145 \times 2.84 \times 10^7 \times .325 \operatorname{tg} 14°40' + 36 \times \frac{.102^2\pi}{4} \times \cos^3 14°40' \cos^3 12°10' \times \left[S - .0145 \times 2.84 \times 10^7 (.325 \operatorname{tg} 14°40' - .1025 \operatorname{tg} 12°10')\right]\right]$$

★ ★ ★

The resulting stress in the imaginary core wire of the rope will give S = 78,800 psi. For Lang lay (introducing $\alpha = +12°\ 10'$) we would obtain S = 97,100 psi. With formula 11 we can then compute the stresses in core wires and outer wires. The results are contained in table I.

We can see that a twist, which certainly cannot be called great, is sufficient to produce considerable changes in the stresses. With growing angle ψ these may become so great that the formulae would not work any more. By opening more the Regular lay rope we might get compression in the core wires. By opening the Lang lay rope we might reach their UTS. In the first case the core wire will develop a tendency to creep out of the strand to relieve the compression. In older times wires were often stranded in layers of opposite direction and sometimes one could see ropes where the inner layers had pressed their way through the outer layer, producing funny specimens of distorted strands. The reason was, that the whole strand forming the core was compressed through rotation, made possible by faulty handling or use.

★ ★ ★

The negative stress in the imaginary core wire of the rope in the table is of no importance because this stress is only an auxiliary figure and not existing any real core wire there is also no real stress.

★ ★ ★

If we want to check the stresses of the table we need only to set them into the formula

$$P = \Sigma f \sigma \cos\alpha \cos\beta$$

and the result must always give 10,000 lbs.

★ ★ ★

We may now recalculate the driving moment already computed

TABLE I

		before rotation	$\sigma = +1°$/in. (opening)	$\sigma = -1°$/in. (closing)
REGULAR LAY	Imaginary rope core wire psi	36,600	78,800	— 5,600
	Strand core wires (6) psi	33,200	24,900	30,200
	Outer wires (36) psi	31,700	33,300	41,600
LANG LAY	Imaginary rope core wire psi	36,600	97,100	—24,000
	Strand core wires (6) psi	33,200	41,500	25,400
	Outer wires (36) psi	31,700	30,100	33,800

for the ropes with $\psi = \Theta$. But in doing so with the slide rule we shall find that these moments (860 lbs-inches for the Regular lay and 1,250 for the Lang lay) have not changed practically with $\psi = 1°$/in. This is quite logical, because the load taken by each strand has not varied at all (β practically the same), while the change in the moment within each strand is little compared with the total moment. This means that the moment will decrease in this rope only slowly through rotation under a free-hanging load and final standstill must come mainly through deformation and the corresponding countermoment.

★ ★ ★

The other example will be the following "non-rotating" rope: Inner rope 6 strands left Lang lay 2 9/16" with fibre core, outer rope right Regular lay 4¼", all strands left lay 1⅛" consisting of one wire .043" and 6 wires .04". Assumed free-hanging load 5,000 lbs, with one revolution in 60 feet of rope which for a free-hanging rope must be in direction of opening the outer right lay rope. ($\psi = +½°$/in = .00872).

★ ★ ★

There will be four groups of wires:

1. Core wires inner rope: f = $8.712.10^{-3}$ square in. R_i = .125", $\beta_i = -17°$
2. Outer wires inner rope: f = $45.25.10^{-3}$ square in. R_i = .125", r = .0415"
   $\alpha = 13° 5'$, $\beta_i = -17°$
3. Core wires outer rope: f = $17.42.10^{-3}$ square in. R_e = .248", $\beta_e = +20° 10'$
4. Outer wires outer rope: f = $90.45.10^{-3}$ square in. R_e = .248" r = .0415"
   $\alpha = -13° 5'$ $\beta_e = +20° 10'$

(Suffixes "i" and "e" refer to inner and outer layer of strands)

★ ★ ★

Now we can, employing formula 14, calculate S and this value once computed we can determine with formula 11 the stresses σ for every group of wires. We shall omit this lengthy calculation, which can be checked by any interested person and give the results in Table II.

TABLE II

	Before rotation	after rotation $\sigma = +1/2°$/in.
Imaginary core wire in rope psi	39,100	48,600
Core wires inner rope stress psi	35,800	52,900
Outer wires inner rope stress psi	34,000	51,500
Core wires outer rope stress psi	34,500	23,100
Outer wires outer rope stress psi	32,700	23,800
Driving moment in-lbs	250	114

We can observe that a small rotation has brought a radical change, both in stresses and in the driving moment. The latter falls to less than one-half of its original amount, while in the ordinary 6 strand-rope with the double value of ψ_1 the decrease of the driving moment was almost imperceptible. That explains why the "non-rotating" rope soon stops rotating, though this great advantage is obtained with a very irregular distribution of stresses in the different wires. That is why we must use such ropes with a higher factor of safety.

★ ★ ★

We now have demonstrated the method of calculating the tangential forces and the consequent driving moments, which try to make the rope to rotate and also the changes in stresses arising from such a rotation. This was the purpose of the article.

★ ★ ★

There are two more problems connected with rotation, which already have been mentioned at the beginning. It is first the question of what is the real breaking strength of a rope after rotation and second the problem of how to determine the final angle ψ at which the rope will stop rotating under a free-hanging load. Though the lack of space makes even a rapid treatment impossible, the author wishes to say, at least, some words on both problems.

★ ★ ★

The calculation of the total breaking strength on a purely mathematical base is not difficult. It is only necessary to put into formula 11 for σ the UTS of the material and compute S. This operation must be repeated for every group of wires and the smallest value of S found entered in formula 14 will give us the theoretical total breaking strength of the rope. But there are several circumstances which advise a careful study of the method before recommending it. One of the most important objections is the fact that the formulae are based on Hooke's law, which in no case is valid near the UTS.

★ ★ ★

To what concerns the calculation of the final angle ψ at which rotation stops, it is evident, that we must take in account the resistance of the wire against deformation. The mentioned study of Mr. F. Dreher is mainly devoted to this problem. But as far as the "non-rotating" ropes are concerned it is possible for practical purposes to neglect the resistance of the material against deformation, because the angle of rotation will be very small. The method for this simplified case would be to compute S and ψ simultaneously. For these two unknowns, there are two equations at disposition, namely, formula 3 ($M = \Theta$) and formula 14 (P = load). Formula 3 must be previously transformed by replacing σ for S. For this purpose formula 11 will be used. The efficiency of different types of non-rotating ropes under different loads can thus be calculated with a reasonable degree of accuracy.

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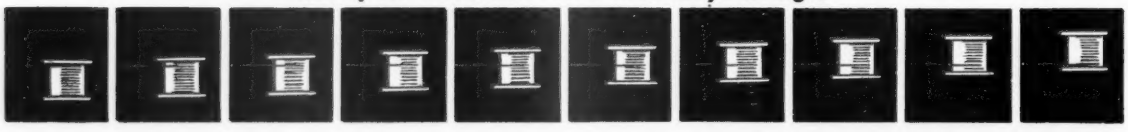

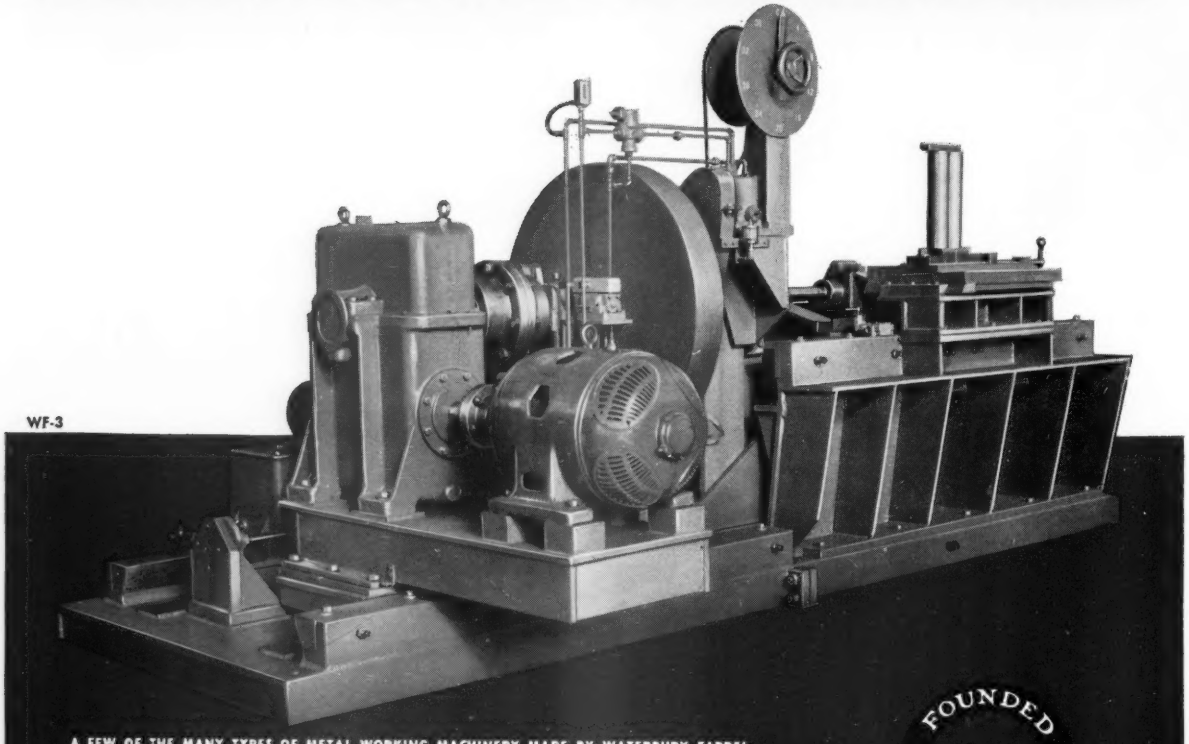

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11:30 A.M.—Busses leave hotel door for Plant Inspection tour of Pittsburg Wire Rope Mill of Columbia-Geneva Steel Division of the United States Steel Corporation.

1:00 P.M.—Luncheon at the Pittsburg Wire Rope Mill cafeteria with the compliments of the company. Please wear your badge and go in the busses. The management has specified that only those members and guests will be admitted who arrive in the busses.

2:00 P.M.—Plant inspection tour of the wire rope mill. Busses will start the return trip to the hotel at approximately 3:00 P.M.

6 - 7 P.M.—Cocktail hour.

7:00 P.M.—Dinner.

8:00 P.M.—Technical Session with two papers as follows, each followed by a discussion period:

PAPER: "Wire Rope Origin and Development" by R. F. Hendrick, Purchasing Agent, E. H. Edwards Company, So. San Francisco, Cal.

PAPER: "Potential Markets for Western Wire Fabricators" by R. E. Oliver, Manager of Commercial Research, Columbia-Geneva Steel Division, United States Steel Corporation San Francisco, Cal.

PROGRAM CHAIRMAN

Joseph N. Kemple
Manager of Wire Rope and Electrical Sales
Columbia-Geneva Steel Div., United States Steel Corp.
San Francisco, Cal.

This will be a fine meeting to attend. Make your plans to be there today. Hotel reservations should be made direct by those who plan to be in San Francisco over night.

FEES: A registration fee of $6.00 will be charged, which includes bus transportation.
Dinner—Sir Francis Drake Hotel—$5.00

THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

453 MAIN STREET **STAMFORD, CONN.**

Properties of Fluorothene Insulated Wire

by W. J. Canavan and A. E. Maibauer
Development Engineers
Bakelite Company
A Division of Union Carbide & Carbon Company
New York, N. Y

Summary

One of the most interesting insulating materials of recent development are those polymers of monochlorotrifluoroethylene known as fluorothene. The use of the term fluorothene as a generic description for those polymers has been suggested and has come into general usage. These materials have extremely interesting properties, outstanding among which are excellent chemical resistance, combined with thermal stability at relatively high temperatures. The properties of fluorothene are such that they fill a gap currently existing in the insulated wire field. Insulations having the unique combination of properties illustrated by these polymers and useful in the 125-150 deg C. temperature range have not been available. This paper summarizes the outstanding properties of the polymer and discusses these properties in some detail. An analysis of the aging performance with particular emphasis on the reasons for this performance is also given.

A paper presented as a part of the Signal Corps Symposium on Insulated Wire at Asbury Park, N. J., on December 10, 1952. It is published through the courtesy of the Bakelite Company.

TABLE I

PROPOSED TENTATIVE RESIN SPECIFICATION

The following properties on fluorothene resins are proposed as tentative specifications.*

		Resin	Melt Viscosity Megapoises at 230 deg. C.
Melt Viscosity at 230°C. - Poises		CF3-5	4-7
		CF3-15	12-21
		CF3-50	37-65
		Method	Resin Grades CF3-5, CF3-15, CF3-50
Hardness,	23°C.	Durometer D	75 - 80
Tensile Strength,	23°C. psi	ASTM 638-46T 0.40" thick Comp. Molded Specimen	4000 - 5000
Elongation	23°C., %	Same as above	
Quenched			40 - 80
Annealed			10 - 20
Modulus of Elasticity, Tensile, psi	23°C.	ASTM 638-46T	200,000 - 300,000
Electrical Properties, 23°C.			
Power Factor at 1000 Cycles			0.02 - 0.03
Dielectric Constant at 1000 Cycles			2.5 - 2.6
Vol. Resistivity, Ohm-cm			Over 10^{14}
Specific Gravity			2.11 - 2.14

*In this proposed specification, ranges are given which appear to be suitable for all three grades of resin with the exception of melt viscosity which is listed for each grade.

Properties

The general properties of the material have been covered in the final Navy report by Bakelite Company.[1] These properties are summarized in Table I.

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The polymer has the general chemical formulation as follows:

The completely halogenated structure of the molecule indicates some of its basic properties. The resistance to burning is, as expected, extremely good. Tests on insulated wire of various sizes and wall thicknesses show that the material will not support combustion—i.e. continue burning after application of a flame—and that there is no evidence of burning fragments falling from the wire.

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The resistivity of an insulating material is of primary importance. While many materials have excellent resistivities at room temperature or slightly above, most of these materials have the undesirable characteristic of dropping sharply in resistivity as the temperature is raised. Fluorothene, on the other hand, has volume resistivity values beyond the upper range of equipment generally used for these measurements at ordinary temperatures. At 210 deg. C. fluorothene resin has a resisti-

(1) "Characterization of Monochlorotrifluoroethylene Polymers" — Union Carbide and Carbon Corporation, December 1950 — Library of Congress, Photoduplication Section, Washington 25, D. C.

vity of 3.4 x 10^{14} ohm-cm. On a typical wire construction, No. 20 AWG wire with a 10 mil wall, this would give a value of 850 megohms —1,000 feet at 210 deg. C. The retention of resistivity at such a temperature is a unique and very useful property.

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The surface resistivity of fluorothene is extremely high. The surface of the resin has the unique property of being very difficult to wet with water. Therefore, conducting paths depending on the presence of electrolytes or moisture are difficult to develop.

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The unbalanced nature of the molecule containing one chlorine and three fluorine atoms would lead one to expect that the power factor and dielectric constant would be higher than that obtained with polyethylene or polytetrafluoroethylene. Figure I shows the variation of power factor and dielectric constant with frequency at a temperature of 23 deg. C. Both the dielectric constant and the power factor are excellent for use over the normal range of frequencies. At the higher frequencies the dielectric losses will generally prohibit the use of fluorothene.

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The dielectric strength of the polymer is of interest. Unaged samples show values ranging from approximately 1500 volts per mil for a 10 mil thickness to 450 volts per mil at a thickness of 150 mils. The dielectric strength encountered after relatively severe aging periods will be discussed in detail later in this paper.

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The chemical resistance of fluorothene is particularly outstanding. There is no known solvent for the polymer in the operating range contemplated. Active solvents such as toluene and carbon tetrachloride have a slight swelling action on the resin which has, however, only a very slight effect on the electrical properties of insulated wire. Fluorothene is particularly resistant to the effects of fuming nitric acid which is normally encountered in some types of equipment where insulated wire is required. The chemical resistance of the polymer is such that it will operate satisfactorily under extremely severe exposure, thus fulfilling a difficult operation requirement.

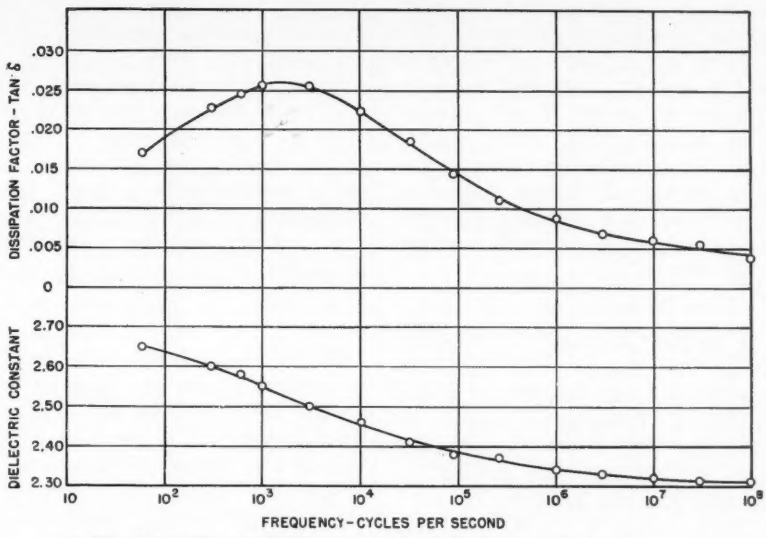

FIGURE I DIELECTRIC PROPERTIES OF FLUOROTHENE RESIN AT 23 DEG. C.

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The moisture resistance of fluorothene wire is excellent. Upon long time exposure to water, the amount of water absorbed cannot be measured, and there is no noticeable change in the electrical properties. Measured water permeability rates are also extremely low.

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Deformation and cold flow are important in those applications where resistance to mechanical loading and stress is required. Fluorothene does not cold flow at stresses below the yield point of the material. A typical stress-strain curve is given in Figure II. For strains up to 4 per cent the deformation is completely recoverable, and as can be seen from the curve, the unit stresses involved are substantial. These properties are retained in very large measure over the temperature range encountered in service.

★ ★ ★

Fluorothene is extremely tough and resistant to abrasion. These properties make it suitable for those uses where mechanical abuse will be encountered and indicate that the insulation does not normally need the protection of a sheath or braid of any sort.

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Fluorothene is best thought of as a rigid material which is, however, quite flexible in thin sections. The change in stiffness over a temperature range of fluorothene

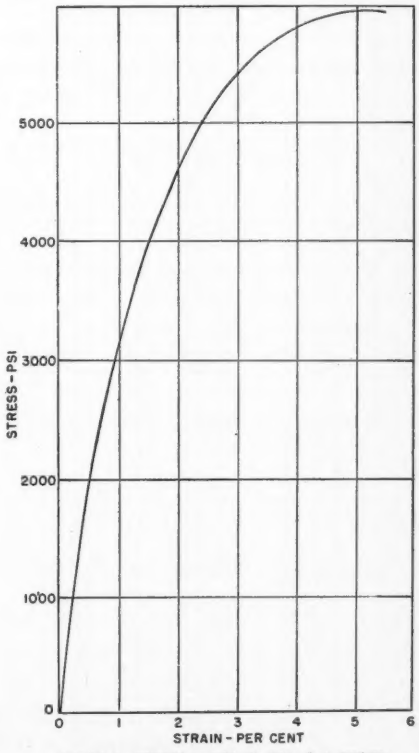

FIGURE 2 STRESS vs STRAIN CF3-15 INJECTION MOLDED AT 525 DEG. F.

is unusual as compared to most organic insulating materials. The polymer varies from a stiffness of 350,000 psi at —50 deg. C. to a stiffness of only 11,500 psi at +150 deg. C. Other organic insulating compounds can evidence the same degree of change shown in fluorothene in a 200 deg. C. temperature span, in as small a range as 50 deg. C.

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It might be well to mention briefly that the polymer, itself, is fungistatic, and inasmuch as no modifying ingredients such as plasticizer, etc., are normally used, there are no nutrients present to promote fungus growth.

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The low temperature properties indicate that down to —40 deg. C. and possibly somewhat lower, the insulated wire is capable of meeting rather severe cold bending tests without difficulty. Insulated wire installed in equipment could unquestionably operate satisfactorily at much lower temperatures provided that there was not a need for very much flexibility in the wire.

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There has been considerable discussion about the type of conductor most suitable for use with fluorothene. For continuous aging at 150 deg. C., it appears desirable not to use plain copper as the conductor. At this temperature copper seems to have a catalytic effect on the degradation of the resin. We have found that tin-coated copper is suitable as is silver-coated copper. For the temperatures currently contemplated for the use of the resin, either one of these conductors is quite satisfactory.

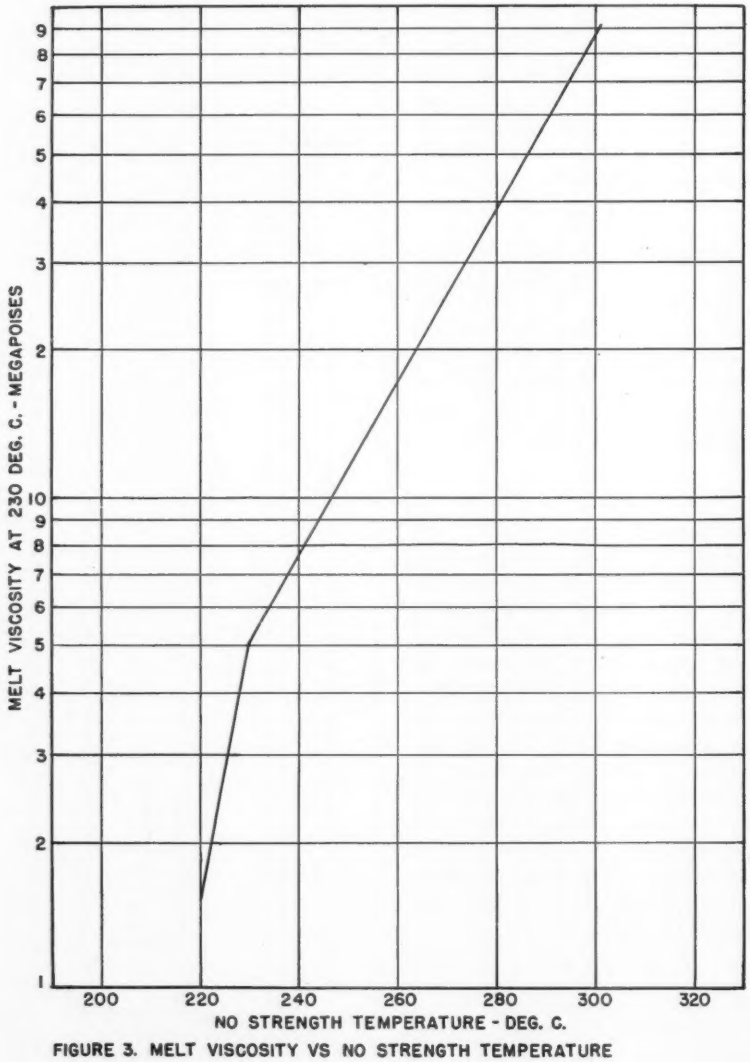

FIGURE 3. MELT VISCOSITY VS NO STRENGTH TEMPERATURE

Tests on Finished Wire

At first glance fluorothene seems to be a rather simple polymer. When some of the results that have been obtained in insulated wire are noted, however, its complexities become more apparent. These results were somewhat baffling when first encountered. They have been made the subject of intensive study, and a considerable improvement has been made over the first rather poor samples of insulated wire that were available. It might be well to consider the results that have been obtained in the past in the light of the latest information which shows that once the facts have been studied and understood, the properties of the insulated wire can be vastly improved.

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Primary emphasis has been placed on the weight average molecular weight of the polymer on the finished wire as being indicative of the performance of such wire. One widely used method to determine this property has been the use of the so-called "no-strength" temperature test, wherein a notched specimen of given dimensions, under a given load, is gradually raised in temperature until failure results due to the lack of internal strength in the specimen. It has been shown that (1) this measurement, when accurately made, can be correlated with the flow index obtained by use of the melt indexer, an extrusion plastometer operating at low rates of shear. A correlation curve is shown in Figure III.

★ ★ ★

Such a correlation is generally accurate, however, only with no-strength temperatures in excess of 230 deg. C. This is not surprising inasmuch as the test to deter-

mine NST values on fluorothene is initiated at 210 deg. C. The first 15 or 20 degrees of temperature rise are devoted to raising the temperature of the specimen, and failure is not likely to be encountered. The temperature range below 230 deg. C. is generally the range in which poor results are likely to be encountered, and is, therefore, of primary interest.

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The "no-strength" temperature test has been adopted in some cases for use on tubular specimens removed from insulated wire. Table II shows the results obtained on such specimens in terms of melt viscosity and NST. As can be seen from this Table, the no-strength temperature obtained is very much dependent on the degree of shrinkage present in the insulated wire specimen. A polymer having essentially the same melt viscosity shows widely varying NST values.

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TABLE II

MV meg.	*% shrinkage*	*NST, °F.*
10.4	3	226
9.5	20	236
9.4	70	262
1.6	48	222

★ ★ ★

Any residual strains present in the insulation will gradually relieve themselves at this temperature and tend to give a higher NST value than might be determined based on the properties of the resin alone. Since it will shortly be shown that it is desirable to have some degree of strain present in insulated wire, the importance of separating these two components increases. We propose that a melt index test, which can be taken on samples removed from insulated wire, is a more useful test. This test gives a value known as the flow index which is very reproducible, and is a function of the properties of the resin alone, not of the resin and residual strains. The melt indexer is a relatively simple instrument to operate and is not subject to the difficulties inherent in a test requiring temperature to be varied rather rapidly with the added problem of determining the exact temperature at the moment of failure. The flow index can be correlated directly with the melt viscosity in megapoises. It is our current belief that the insulation on wire should have a viscosity of at least 1.5 megapoises. Insulations with this viscosity can be obtained by starting with resins having a melt viscosity of 5 megapoises and by carefully controlling the extrusion conditions as covered by Maddock and Land.[2]

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It has been recognized that fluorothene is a crystalline polymer. This crystallinity, which is responsible for the sharp melting point, toughness, and stiffness properties of the resin, must also be controlled so that it does not contribute any undesirable properities to the finished wire. Such control can be maintained so that the finished wire is useful up to a temperature of 150 deg. C. at the present state of the art. The crystallinity present in fluorothene results, as the resin is cooled from extrusion temperature, in the development of nuclei around which crystallites grow. These crystallites tend to form aggregates of crystals which line up in more or less a sheaf-like manner in the polymer. These aggregates of crystallites, known as spherulites, continue to grow until the growth is stopped, generally by the adjacent interfaces of spherulites blocking each other. The larger the spherulites, and the greater the percentage of crystallinity, the more brittle the resin becomes. This brittleness can lead to cracking during mandrel bend tests and loss of dielectric strength. It is certainly desirable to cool the resin as rapidly as possible so that the degree of crystallinity as well as the size of the spherulite growth will be limited. This results, initially, in extremely good properties of the insulated wire. However, during elevated temperatures aging, particularly at temperatures in the neighborhood of 150 deg. C. or higher, there is a tendency for crystalline growth to continue. This tendency can be minimized by reducing as nearly as possible the mobility of the long molecular chains in the polymer. The mobility of the chains can be minimized by keeping the length of the chains high, i.e., maintaining the viscosity as high as practical. Spherulite development can also be reduced by orienting the resin which tends to position the crystallites parallel, one to another. Even though such a resin becomes just as crystalline as unoriented resin during heating, the crystallites remain parallel, and spherulite growth is minimized.

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(*Please turn to page* 503)

(2) Maddock, B. H. and Land W. M. — "Fluorothene Wire Insulation" MODERN PLASTICS, December 1952.

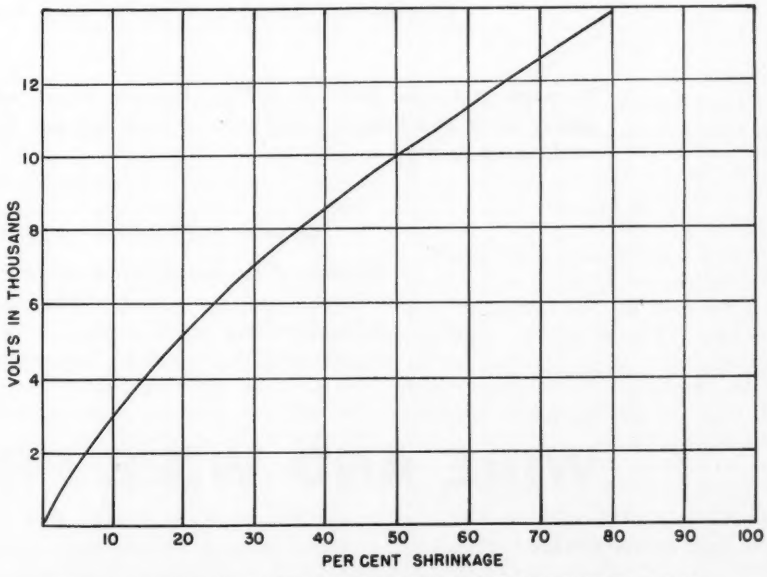

FIGURE 4 SHRINKAGE vs VOLTAGE BREAKDOWN AFTER 1 WEEK AT 150 DEG. C.

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WIRE AND WIRE PRODUCTS

453 MAIN STREET **STAMFORD, CONN.**

Development of Light Weight Spiral-Four Cable

by Howard T. Knox

Electrical Engineer, Development Department
United States Rubber Company
Bristol, Rhode Island

This paper is one of a series of technical lectures delivered at the Signal Corps Symposium on Communication Wires and Cables at Asbury Park, N. J., held from December 8th through the 10th, 1952. It is published by permission of the author.

During World War II, a portable four-conductor field communication cable, popularly called Spiral-Four Cable, was used extensively by the Signal Corps for the transmission of voice- and carrier-frequencies up to 12.5 kilocycles. Quarter-mile lengths of this cable were terminated with molded connectors, each connector containing a 6-mh loading coil that was inserted in the circuit for the purpose of decreasing transmission losses.

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Spiral Four cable was designed to stand up under rough handling. However, in an emergency it was often used, for example, as submarine cable for island-to-island communication in the South Pacific, or as self-supported aerial communication cable in the mountainous terrain of the Burma Road area. While Spiral Four Cable stood up as well as could be expected under these severe operating conditions, the Signal Corps was not at all satisfied with the cable's overall performance. They felt that the possibility of developing a portable field cable with greatly improved electrical and mechanical characteristics should be investigated. As long ago as the summer of 1945, the United States Rubber Company and the Signal Corps discussed, more or less informally, the development of such a cable. When the war ended in August, 1945, the problem was temporarily shelved, but early in 1946, the Signal Corps issued a tentative specification which outlined the requirements for two smaller, lighter, four-conductor cables, designated Light-Weight and Ultra-Light-Weight Field Cable.

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The tentative requirements for diameter, weight, attenuation, and maximum operating frequency of these two cables are shown in the following table:

TABLE I

	Max. Diameter (ins.)*	*Max. Weight* (#/M')*	*Max. Attenuation (Db/mile @ 1KC)*	*Max. Operating Frequency (KC)*
Ultra-Light-Weight Cable	.276 (65%)	44 (40%)	1.00	16
Light-Weight Cable	.340 (80%)	66 (60%)	0.75	50-100**

* The weight and diameter requirements for these two cables were expressed as percentages of the weight and diameter of the old Spiral-Four cable, 110#/M' and .425", respectively. These specified percentages are shown in parentheses in the above table.

** At least 50 KC; as high as 100 KC, if possible.

Later in 1946, the United States Rubber Company was awarded a development contract by the Signal Corps to develop two cables that would meet these tentative specification requirements, if possible.

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In the initial calculations, it was assumed that the construction details of the Ultra-Light-Weight and Light-Weight cables would, in general, be about the same as the construction details of the old Spiral Four Cable, which are as follows:

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Each conductor consists of seven strands of .0152" diameter tinned copper insulated with a low-S.I.C. GR-S compound to approximately .128". Four conductors, two black and two white, are cabled around a .053" dia. GR-S or plastic core. An aluminum-foil, paper-backed stabilizing tape is next wrapped spirally over the cabled conductors. A creped-paper dam is then applied straightaway to serve as a bedding for the steel braid armor which is applied next. The braid consists of 16 ends of .013" diameter, 300,000#/ins.^{2} galvanized steel, and it gives the cable a 600-700# breaking strength. Finally, a neoprene jacket is extruded over all to a diameter of .425", giving the cable a tough, flexible, water-resistant outer covering.

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With the diameters shown in Table I as a basis for calculation, the weights and attenuations of eighteen Light-Weight and six Ultra-Light-Weight constructions were determined. In these cables, various combinations of bare and tinned stranded copper conductors, polyethylene and natural-rubber-latex insulations, and polyethylene, vinylite and neoprene jackets were considered. Without going into detail, the following conclusions were drawn from these calculations:

1. It was impossible to meet all the the requirements for Light-Weight Field Cable. If weight and diameter were to be the primary considerations, a compromise between attenuation and the top operating frequency was necessary.
2. It was apparently possible to meet all requirements for Ultra-Light-Weight Cable, provided bare copper conductors and polyethylene insulation were used.

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The first phase in the development of these two cables covered the two-year period of May 1, 1946 through April 30, 1948. During this period, some thirty-three cable constructions were considered. Samples of most of these cables were manufactured, and were tested mechanically, and electrically. Analysis of the test data made it possible to eliminate the weak or defective constructional features of each cable sample, and to retain the more desirable features, passing them on from one sample to the next. Time will not permit a detailed account of the strong and weak points of each cable construction, but some of the more important conclusions reached can be mentioned briefly:

FIRST, location of the steel strength member in the core decreases the impact resistance of the cable.

SECOND, use of a flat rather than a round, steel wire in the steel-braid armor decreases the flex-twist resistance of the cable.

THIRD, a steel braid is preferable as a strength member to braids of high-strength non-metallic materials, such as fiberglas or nylon. A steel braid is more easily anchored to a cable connector, and provides the cable with a relatively low-resistance path to ground. Poor bond between the outer jacket and a non-metallic-braid strength member allows the jacket to be stripped too easily, an undesirable feature in this type of cable.

FOURTH, a braid of low-permeability, high-tensile 18-8 stainless steel, must be used as the strength member, to provide a cable with minimum attenuation and maximum breaking strength.

FIFTH, a polyethylene belt, extruded over the four cabled conductors before the stabilizing tape is applied, increases impact resistance, and provides an excellent moisture seal should the outer jacket become torn or pierced. Penetration of moisture into the core of the cable would change the mutual capacity and hence the impedance of the cable, and would greatly increase the attenuation. Also, a polyethylene belt decreases the capacity unbalances.

SIXTH, a semi-conducting carbon-impregnated cloth tape provides adequate electrical stabilization, and can be handled more easily than the aluminum-foil paper-backed tape during production. Furthermore, use of a non-metallic stabilizing tape results in lower attenuation at high frequencies.

SEVENTH, a thermoplastic jacketing material, such as perbunan-vinylite, is preferable to neoprene for two reasons: (1) Perbunan-vinylite is designed to perform satisfactorily at a lower temperature than neoprene,—55° C as compared to -40° C. (2) The Neoprene jacket would necessarily have to be cured at relatively low temperatures to prevent distortion of the polyethylene insulation. Because of the length of time required for a low-temperature cure, manufacture of neoprene-jacketed Light-Weight cable on a large-scale basis would be impractical.

EIGHTH, and probably most important, the Signal Corps concluded that, by modifying their original requirements, only one cable, an Ultra-Light-Weight construction, would be needed.

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Construction details of this Ultra-Light-Weight Cable that most nearly met Signal Corps requirements are as follows:

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The conductors are made up of 7 strands of .0136″ diameter bare annealed copper (#19 AWG) insulated to a diameter of .076″ with polyethylene. Four of these conductors, two brown and two natural, are cabled with a 2¾″ R.H.-Lay around a .031″ diameter polyethylene filament. A .025″ wall of natural polyethylene is then extruded over the four cabled conductors to provide a moisture seal. Next, a ¾″ semi-conducting carbon-impregnated-cloth stabilizing tape is applied spirally. A steel braid, consisting of 32 ends of .008″ diameter 300,000# 18-8 stainless steel is then applied. This is a 2-ends-per-carrier, 16-carrier braid, applied with 6 picks per inch. Finally, a Perbunan-Vinylite jacket is extruded overall to a diameter of .335″. The weight of this cable is 58#/M′, and the attenuation is 1.25 db/mile @ 1 KC.

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At this point, the first phase in the development of a Light-Weight Field Cable was completed, with the basic cable design having been established. This was the 28th cable construction in the series of 33 under consideration, and it will hereinafter be referred to as Cable #28. Also, the expression, "Light-Weight", rather than "Ultra-Light-Weight", will be used when reference is made to this cable being developed.

The United States Rubber Company was awarded a second development contract by the Signal Corps to continue development work on the Light-Weight cable, and also to determine the nature of the problems that would arise during full-scale production of Light-Weight cable.

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Work on the second phase of Light-Weight Field Cable development began officially on January 1, 1949 and continued through April 30, 1951. The first objective was to improve the mechanical characteristics of Cable #28.

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After some discussion, it was decided that this could best be accomplished by first investigating the effects of minor changes or variations in cable construction. These changes were: (1) variation in lay at the cabling operation over the range of 1½″ to 2¾″, (2) dusting conductors with talc at the cabling operation, and (3) variation in the size and total number of ends of steel used in the steel braid. Several cable samples, in which combinations of these three variations were incorporated, were then manufactured and tested.

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After reviewing the results of impact, flex-twist, and breaking-strength tests made on these modified Cable #28 samples, the following conclusions were reached:

1. **Application of talc improves impact and flex-twist resistance, but increases the attenuation, and apparently increases capacity unbalance. Furthermore, it was felt that uniform application of talc on a production basis could be difficult. Consequently, the idea of using talc was discarded.**
2. **Shortening the lay on the conductors improves flex-twist resistance.**
3. **Use of a single-strand braid, of the same material as, and equivalent in cross-section to, the two-strand braid, will improve breaking strength.**

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At about this point in the development program, the Signal Corps required 25 miles of finished cable for field testing. Although they wanted to see the mechanical

properties of Cable #28 improved still further, they did feel that the best modification of Cable #28 produced to date would be acceptable for field tests. Construction details of this cable are as follows:

Dia. (Ins.)	Construction Details
.041	#19—7/.0136″ Soft bare copper
.076	.0175″ wall polyethylene, 2 cdrs. brown, 2 cdrs. natural
.183	4 cdrs. twisted around a .031″ polyethylene filament with a 2″ RH Lay
.233	.025″ wall natural polyethylene
.239	¾″ wide x .033″ thick semi-conducting tape
.291	.013″ 18-8 stainless steel braid—16 carriers—6P/″
.355	.032″ wall Perbunan-Vinylite. Wt. —69#/M′

Some of the mechanical and electrical characteristics of the old Spiral-Four Cable and this new Light-Weight Field Cable are given in the following table:

	Spiral Four Cable	Light-Weight Cable
Diameter, Ins.	.425	.355
Weight, #/M′	110	69
Max. Operating Frequency, KC	12.5	20
Transmission Losses, db/mile		
Unloaded Cable		
@ 1 KC	1.3	1.3
@ 8 KC	2.5	2.6
@ 11 KC	2.7	2.8
@ 20 KC	3.0	3.0
@ 30 KC	3.4	3.2
Loaded Cable		
@ 1 KC	.75	.64
@ 8 KC	.85	.65
@ 11 KC	.95	.66
@ 20 KC	—	.83
Breaking Strength—Lbs.	660	600
Min. Operating Temperature—°C.	—40	—55
Impact Test*	246	253
Flex-Twist Test**	1142	1619

* Frankford Arsenal Impact Test—15# Wt.—1″ diameter rounded striking surface —6″ drop. Number of cycles at failure as shown. Ave. 6 samples.

** Frankford Arsenal Flex-Twist Test 30# Weight—3″ dia. pulley—180° Twist. Number of cycles at failure as shown. Ave. 6 samples.

Manufacture of the 25 miles of Light-Weight Cable for field testing, and final development work on further improvement of the mechanical characteristics of Light-Weight Cable proceeded concurrently from this point.

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Again, several Light-Weight cable samples were run, but with variations in only the steel braid. Various combinations of steel braids with .013″, .014″ and .015″ diameter 18-8 stainless steel were applied with 4, 5 and 6 picks per inch to the semi-conducting-taped four-conductor core of Cable #28. After reviewing mechanical test results, it was concluded that the sample with the .015″ stainless steel braid applied with 5 picks per inch would give the best performance mechanically for the following reasons: (1) high flex-twist resistance on all .015″-dia.-steel-braid samples, (2) high breaking strength (700#) on all .015″-dia.-steel-braid samples and, (3) better impact resistance on the 5-picks-per-inch .015″-dia.-steel-braid sample than on the 4- and 6-picks-per-inch samples. This braid was later changed back to 6-picks-per-inch, or 5.75, to be exact, for manufacturing reasons. Also, the O.D. was increased from .355″ to .365″, so that the jacket wall thickness would remain unchanged.

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Thus, in the spring of 1950, final design of the Light-Weight Field Cable was established. Construction details including weights of each component and diameters at each operation are shown in the following table:

Wt.—#/M′	Dia. (ins.)
16.1	.041
5.6	.076
.3	.183
9.5	.233
1.4	.239
11.9	.299
31.6	.365
Total 76.4 #/M′	

Construction Details

#19 7/.0136″ bare soft copper
.0175″ wall polyethylene, 2 cdrs. brown, 2 cdrs. natural
4 cdrs. twisted around a .031″ polyethylene filament with a 2″ R. H. Lay
.025″ wall of natural polyethylene
¾″ wide x .003″ thick Pacific Mills Type B semi-conducting tape
.015″ 18-8 stainless steel braid 16 carriers—6 P/″
.033″ wall Perbunan-Vinylite
(.370″ max. O.D.)

★ ☆ ★

This cable construction, except for some minor changes in operations, materials, material suppliers, etc., is identical to the Light-Weight Field Cable now being manufactured in large quantities by six cable manufacturers.

★ ★ ★

The Signal Corps had one other reason for requesting the manufacture of this 25-mile lot of Light-Weight cable at this time. Before repeater design and spacing could be established, the magnitude of the capacity unbalances to be expected in production lots of cable had to be known. This paper is concerned with only two kinds of capacity unbalance: side-to-side and side-to-ground.

★ ★ ★

Excessively high side-to-ground capacity unbalance will cause the cable to be "noisy," whereas excessively high side-to-side capacity unbalance will cause crosstalk.

★ ★ ★

These capacity unbalances are defined graphically in Figure 1 (attached). The magnitude of the side-to-side or side-to-ground capacity unbalance of a length of cable can be determined by substituting the conductor-to-conductor or conductor-to-ground capacity values, as indicated, into the equations shown in Figure 1. (See below)

★ ★ ★

Capacity unbalance is non-existent so long as the cable is on the drawing board, but very much in evidence as soon as manufacturing begins. Unfortunately, minor variations do occur in even the most closely controlled manufacturing operations. These variations, relatively unimportant in most cables, show up as capacity unbalances in communication cables. As soon as manufacture of the 25 miles (100 ¼-mile lengths) of Light-Weight cable had been completed, the capacity unbalances were measured. The average side-to-side unbalance was found to be 19 mmf; the average side-to-ground unbalance, 285 mmf. Thus, with these figures serving as a guide, tentative specification capacity-unbalance requirements could now be established. As production of an additional 580 quarter-mile lengths progressed, however, it appeared that the side-to-ground unbalance requirements could not be met consistently and, consequently, they were changed. Later, as production continued on a larger scale and manufacturing techniques were developed, the capacity unbalances decreased gradually, and are currently well within specification limits. The following table gives the original measured capacity unbalances, tentative and final specification requirements, and current-production capacity unbalances:

	Capacity Unbalance (mmf per ¼-mile length)			
	Side-to-Side		Side-to-Ground	
Spiral-Four Cable	Ave.	Max.	Ave.	Max.
(1) Specification Requirements		300		1500
Light-Weight Cable				
(1) Ave. measured values—1st 25 miles	19		285	
(2) Tentative Spec. Requirements	20	75	280	1000
(3) Final Spec. Requirements	20	75	450	1250
(4) Ave. measured values—current production	< 5		230—350	

During production of the old Spiral-Four Cable, such things as variation in conductor-insulation diameter, variations in tensions at the cabling operation, and insulation distortion caused by the neoprene-jacketing operation, all contributed to side-to-ground capacity unbalance. During Light-Weight cable production, variations in conductor-insulation diameter are considerably smaller, and insulation distortion has been practically eliminated. In spite of this, high-side-to-ground capacity unbalance was quite a problem during the early stages of production. Physical comparison of low- and high-unbalance lengths of Light-Weight cable failed to reveal any significant visible differences between them, differences to which the high-unbalance could be attributed.

★ ★ ★

Furthermore, our search for the solution to this problem was hampered by the one- or two-week lag between the inception and detection of the high-unbalance. For example, suppose the high capacity-unbalance of a particular length of cable had resulted from something that occurred during the conductor-insulating operation. This high-unbalance condition would not be detected until after the steel braid had been applied, some one or two weeks, and four or five manufacturing operations later. At this time, as far as could be determined, the high-unbalance could have resulted from the cumulative effect of several factors. Consequently, isolation and identification of each specific unbalance-producing factor proved to be a difficult job.

★ ★ ★

After a period, however, continued investigation into the cause or causes for high side-to-ground unbalance finally revealed the existence of only two major high-unbalance contributors. These were, (1) Use of low-viscosity, or high-melt-index polyethylene as conductor insulation and (2) Failure to confine within narrow limits some variations in the polyethylene inner-belt extrusion operation. The low-viscosity polyethylene conductor insulation apparently absorbs enough heat dur-

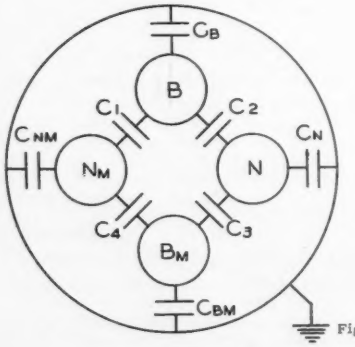

Fig. 1

Conductor Designation

N - Natural
B - Brown

NM - Natural Mate
BM - Brown Mate

Side-To-Side Capacity Unbalance
$= [C_1 + C_3] - [C_2 + C_4]$

Side-To-Ground Capacity Unbalance
$= C_B - C_{BM}$ (brown pair)
$= C_N - C_{NM}$ (natural pair)

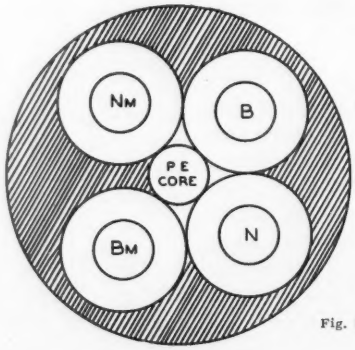

Fig. 2

Side-to-Side Capacity Unbalance

$= [C_1 + C_3] - [C_2 + C_4]$

$C_1 = C_2 = C_3 > C_4$

ing the polyethylene inner-belt extrusion operation to cause softening which, although producing no visible insulation distortion, does result in increased capacity unbalance. Also, at the polyethylene inner-belt extrusion operation, such things as spacing between the insulating guide and die, temperature of the polyethylene at the point of extrusion, wire speed, cooling-water temperature and rate of cooling were all found to be critical. Consequently, by using high-viscosity polyethylene and by exercising tight control over the polyethylene inner-belt extrusion operation, it was possible to consistently produce Light-Weight cable whose average* side-to-ground capacity unbalance was generally in the range of 230 to 350 mmf per ¼-mile length.

★ ★ ★

High side-to-side unbalance, although a problem from time to time, was not nearly as troublesome as high side-to-ground unbalance. It has been our experience that high side-to-side unbalance will be caused only by an oversized polyethylene core. That is, of course, provided manufacturing operating conditions are such that cable with low side-to-ground unbalance is being produced.

★ ★ ★

During the development of Light-Weight cable, a few cases of extremely high side-to-side capacity unbalance were encountered, and in each case, an oversized core was found to have been the cause.

★ ★ ★

The reason for this can best be illustrated by Figure 2.

★ ★ ★

The conductors cannot lay-up perfectly around the oversized core; i.e., lay-up so that each conductor is just touching the conductor on either side of it. While three of the conductor-to-conductor capacities are equal, or nearly so, the fourth conductor-to-conductor capacity is somewhat smaller because of the increased thickness of polyethylene between conductors. By referring to the equation for side-to-side capacity unbalance, shown in Figures 1 and 2, it can be seen that $(C_1 + C_3) - (C_2 + C_4)$ will be considerably greater than zero.

★ ★ ★

So, in conclusion, it can be said that the Signal Corps's principal goal has been reached. Four to five years development work has resulted in the design of a Spiral-Four-type cable, acceptable to the Signal Corps, a cable which is smaller, lighter, more versatile, and far superior electrically and mechanically to the old Spiral-Four Cable.

* Average of shipping lots generally consisting of 100 ¼-mile lengths each.

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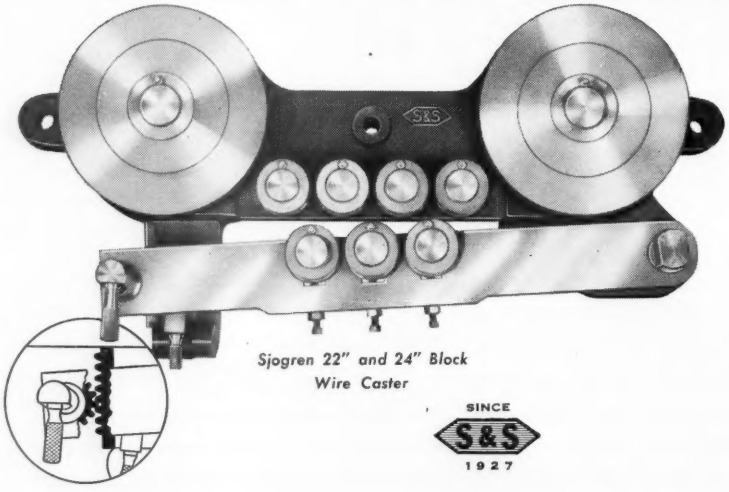

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Restoration of the First Iron Works

One of America's earliest industrial landmarks, the first successful ironworks to be operated in the colonies, is being restored at Saugus, Massachusetts, 10 miles north of Boston.

★ ★ ★

The ironworks, which dates back to 1646, is being reconstructed by the First Iron Works Association, Inc. with financial support of American Iron and Steel Institute.

★ ★ ★

The colonial ironworks is being restored as an industrial shrine to honor the founders and ironworkers of Saugus, pioneers of America's iron and steel industry. When the restoration is complete, the nation will have a worthy monument of a project which helped mold America. For from a humble beginning at Saugus three centuries ago, the steel industry has developed to become a factor of major importance in American economic life.

★ ★ ★

For the past four years extensive exploration and reconstruction work has been going on at the site. A public dedication of this shrine to the pioneers of the American iron and steel industry is scheduled for the summer of 1954.

Units To Be Restored

The original units of the colonial ironworks are being rebuilt. They include the blast furnace, forge, slitting mill, wharf, and a warehouse for storing completed products. Near the site stands the Iron Master's House, restored about 1915 by the late Wallace Nutting, artist and photographer of New England scenes.

While of interest to every American, the notable project described herein should be of especial interest to those concerned with the manufacture and processing of steel. The Saugus Iron Works is the cradle from which our American steel industry has come of age, to stand today as the world's largest producer of steel. This article is published through the courtesy of the American Iron and Steel Institute.

A Team Operation

The process of unearthing America's industrial past is a team operation utilizing the skill and experience of historian, archaeologist, architect and builder. Following clues found in fragmentary written records by the historian, the archaeologist and his crew probe the ruins searching for evidence of the ancient ironworks. Unearthed relics are carefully measured and examined and the data recorded. From the archaeological evidence and from items in literature on early iron making, architects draw plans for the ironworks buildings which are being constructed on the original sites.

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Heading the historical phase of the project is Professor E. N. Hartley of the Massachusetts Institute of Technology with the assistance of colleagues in England and on the Continent. Chief archaeologist is Roland Wells Robbins, who gained a reputation throughout New England by discovering the exact site of Thoreau's cabin at Walden Pond. The architects are Perry, Shaw and Hepburn, Kehoe and Dean, of Boston, the firm which restored Colonial Williamsburg. Construction work is being done by the W. M. Bogart Company. All have readily available to them the technical resources of the American iron and steel industry.

Ironworks Established Three Centuries Ago

The Saugus works was created three centuries ago principally through the efforts of John Winthrop, Jr., son of the founder of Boston, and Richard Leader, a merchant of Salehurst, England. Winthrop promoted the plan to develop New England's iron resources while Leader actually established the works.

★ ★ ★

To run the ironworks a company was organized in England known as the "Company of Undertakers for the Iron Workes in New England." Investors included merchants, iron masters, lawyers, brewers, civil servants, merchant tailors, a physician and several clergymen. The starting capital was 1,000 pounds sterling advanced by residents of England and of the Massachusetts Bay Colony. Later investments brought the total to about 15,000 pounds. A bold capitalistic enterprise, the company probably was the first of its kind in the American colonies.

★ ★ ★

The site selected for the ironworks had a number of natural advantages. Saugus was on the main route, halfway between Boston and Salem. Nearby were ample supplies of bog ore, extensive woodlands, a natural elevation to serve as a base for the charging bridge and a navigable stream which could be dammed to provide the necessary water power.

Ironworks A Large Operation

The ironworks, a sizeable operation for its day, was a completely integrated plant, utilizing the most modern methods of ironmaking

then known. The huge blast furnace, which operated about 30 weeks of the year, produced just over a ton of cast iron a day. The works' slitting mill was one of the few existing in the world at that time.

★ ★ ★

Skilled workmen produced from the metal smelted in the roaring blast furnace such cast iron objects as pots and firebacks and crude iron sows and pigs. The latter were carried to the forge, where in finery and chafery operations they were reheated, converted into wrought iron and beaten into bars under a huge water-power-driven hammer. From the forge the bars went to the slitting mill, and were worked into strips and rods.

★ ★ ★

Many finished products were sold at the site. Some were hauled by boat or by cart to meet the needs of smiths and merchants in nearby towns. Others were shipped to a central warehouse in Boston for local sales or shipment overseas.

Workers Imported From Britain

To operate the ironworks, skilled workers were imported from England and local residents were trained in the art of ironmaking. A number of Scots, who had been taken prisoner by Cromwell's forces in his victory over the Royalists at Dunbar, were also brought over to work out their period of indentured service.

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Among the employees of the Saugus works were Joseph Jenks, who operated a shop just below the blast furnace site. One of New England's earliest inventors, Jenks, in 1646, received America's first mechanical patent for "engines of mils to goe by water." For years historians have puzzled over what operation the "engines" performed. Excavation of his forge some day may give us the answer. Unverified legend also attributes to Jenks the making of the dies for the Pine Tree Shilling.

Saugus Works A Training Ground

In addition to turning out a good grade of iron, the Saugus plant provided a training ground for skilled workers in this vitally-needed industry. From the original ironworks, ironmen and masters spread out throughout New England and down the Atlantic seaboard. New ironworks sprang up at Concord, Rowley, Taunton, New Haven and Providence. However, about 1675, after years of dwindling operation, the pioneer Saugus works was abandoned and fell into ruins.

★ ★ ★

Back of the ironworks' failure lay many factors. There was mismanagement by several of the ironmasters, the supply of raw materials began to run out, the new ironworks was unable to meet the competition of imported iron, the managers found themselves in conflicts with local authorities and it became increasingly difficult to keep skilled workers in a new settlement where land was cheap.

Iron Master's House Saved

This ancient site, overgrown with brambles, might have remained obscure except for the loyalty of a group of New Englanders led by Miss M. Louise Hawkes, whose ancestors lived in Saugus as far back as 1630.

★ ★ ★

In 1942, a number of graduates of the Ford Trade School bought the old Iron Master's House with a view toward moving it to Greenfield Village at Dearborn, Michigan, as a gift to the late Henry Ford. Miss Hawkes was familiar with local traditions concerning the ironworks and believed that what originated in New England should remain there. She carried her fight to keep the house in Saugus to Governor Saltonstall, and finally, with the cooperation of Henry Ford himself, the structure was allowed to remain in New England. Another group played an important role in this period. This was the Parson Roby Chapter of the Daughters of the American Revolution which purchased the land on which the furnace, slag pile, and Jenks' forge had stood.

First Iron Works Association Formed

The First Iron Works Association, Inc. was formed in 1942 to carry on the work of focusing public attention on the site. To one of its meetings in 1946 came Quincy Bent, a retired steel executive and a summer resident of nearby Cape Ann. Recognizing the ironworks as Americana of prime significance, he discussed the project with officers of the Association. As a result of this meeting, he passed on to the Board of Directors of American Iron and Steel Institute what was then known about America's first successful blast furnace. The Institute quickly gave assurance of financial support.

★ ★ ★

Shortly thereafter, Archaeologist Robbins was engaged. He began investigating the grass-covered mound which proved to be the old slag dump, and soon uncovered the remains of the blast furnace. The search went on until other main features of the ironworks were disclosed.

Tons of Relics Recovered

During the past few years, over five tons of artifacts have been taken from the ruins. They ranged from brass pins so small as to be almost invisible to the unaided eye to a 505-pound iron hammer-head used in the original forge building. These, together with recovered iron pots and pans, knives, axes, scissors, pieces of leather shoes and broken pottery, are providing a wider knowledge of life in the American colonies three centuries ago.

Original Waterwheel Found

The most important find to date is a huge waterwheel, 17 feet in diameter, which served to power the bellows of the blast furnace. Covered with moist earth, which undoubtedly preserved the old oak and pine boards, the remains of the wheel were discovered in 1951. It was located 21 feet below the street surface, less than 10 feet from the stone furnace.

But finding the wheel was only half the job. It then had to be removed and measured so a workable replica could be made. Once taken from its mud bath the wheel began to crumble and disintegrate. Experts from Harvard University were called upon and Professor Elso S. Barghoorn of the biology department quickly developed a unique preserving process. Sections of the wheel were carefully removed, wrapped in water-soaked burlap and rushed to the Harvard University laboratories. There they were placed in large vats of melted paraffin wax. During a three-hour heat treatment the water in the wood vaporized and was replaced by the wax. The wax was then allowed to cool and harden, leaving the treated sections almost as solid as the day they were made.

Blast Furnace Completed

Today the ancient ironworks once again throbs with activity as skilled workmen re-create the three-century-old plant. The first and major unit of the ironworks was completed last summer. It is a replica of the original blast furnace with the "blast" furnished by two huge leather bellows operated by a waterwheel.

★ ★ ★

The second unit of the works, now under construction, is expected to be completed by fall of 1953. It is a reconstruction of the old forge building where sow iron made in the blast furnace was converted into merchantable bar iron. Plans for the remainder of the plant are now well under way.

Ironworks Open To The Public

The ironworks site is open to the public seven days a week. Visitors are welcome to tour the Iron Master's House, which has been completely refurnished with period pieces, visit a museum on the grounds which exhibits relics unearthed at the site, or to view the reconstruction activities from the restored charging bridge of the blast furnace.

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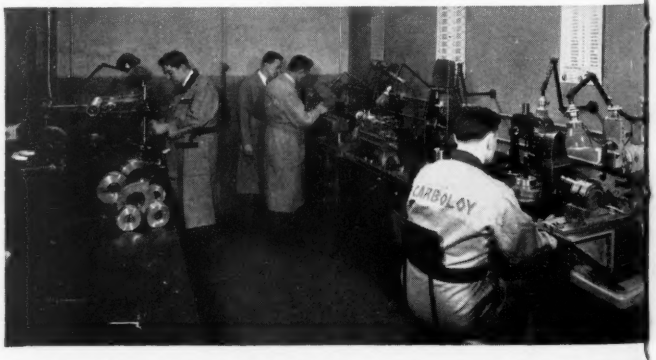

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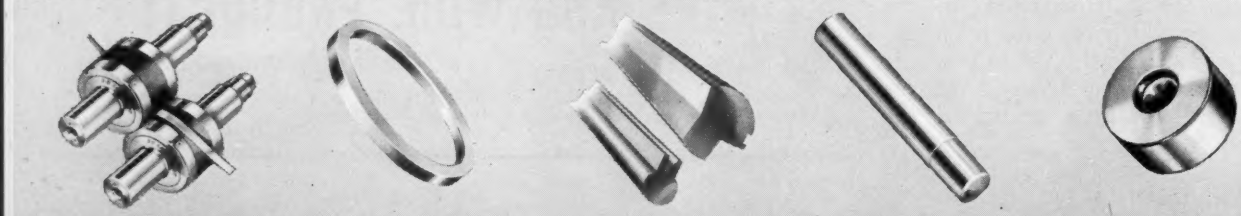

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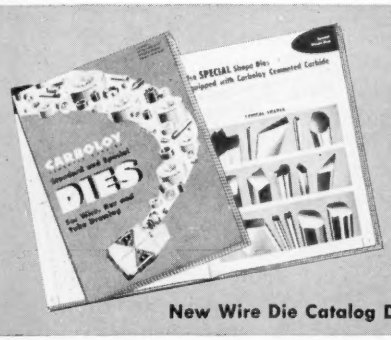

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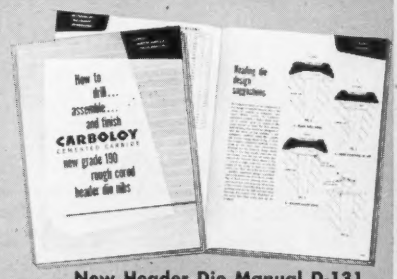

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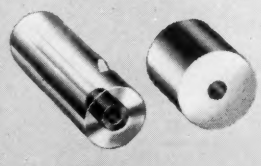
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Material Evaluation

by Andrew LaCorte
Brooklyn, New York

Mr. LaCorte has spent twenty-one years in the wire industry, fifteen of which were as Mill Superintendent of the Kay Manufacturing Company, spring manufacturers. Out of his long experience in drawing wire, he evolved the slide rule, the use of which is described in this article.

The slide control device discussed here is designed to evaluate and pre-determine the end result of a known rod chemical analysis before drawing.

★ ★ ★

In the wire drawing field, it is necessary to take a variety of factors into consideration, the correlation of which is often made difficult by certain phenomena. Since the average millman is usually confronted with the perplexities of these unexplainables or uncontrollables, it is better to start working with those facts that are free of unknowns, from which to get at other points that are involved in our calculations.

★ ★ ★

We are often concerned, particularly in the drawing of high carbon wire, with certain possibilities of either the elimination or introduction of materials, as for instance, the trend in recent years of H. C. mills to eliminate lime. It takes a great amount of time, for experimentation uses up good material and perhaps creates a good bit of scrap, before a decision can be arrived at as to how to get along without lime.

★ ★ ★

With the application of established controls, either by records or graphs that are properly correlated, one would be in a better position to detect the trend of the subject being tested.

★ ★ ★

I have found that an excellent control is a simple slide by means of which one can determine what the tensile of the finished wire will be, using the known factors and elements prior to drawing. This slide control has proven successful in use. For example, knowing the three major elements —C, Mn. and P., plus rod tensile, it is possible to proceed to apply this information to the slide control, which is only an indicator, for all the combined facts shown by the graphs and records accumulated over a period of time. This in turn brings to the surface the relative facts of the aforementioned elements. In spring steel, I have found, in effect, that .15 C. is equivalent to .17 Mn; that .030 P. is equivalent to .05 Mn; and that 30,000 p.s.i. rod tensile is equivalent to .05 Mn., using Mn. on the slide as a determinator. These points, however, are applied to the slide on the basis of plus or minus a standard setting and, as described, gives the tensiles one should get for various gauges.

★ ★ ★

Using an established control for evaluation, such as the slide type or graph type, the guesswork when experimenting with new materials is removed, as one would test perhaps 50 or 100 pounds of finished wire to determine whether the tensile has increased or decreased. Should the tensile increase above the standard that has been established on our slide control, we would then know that the added work hardening would indicate that the trial material was not a good choice.

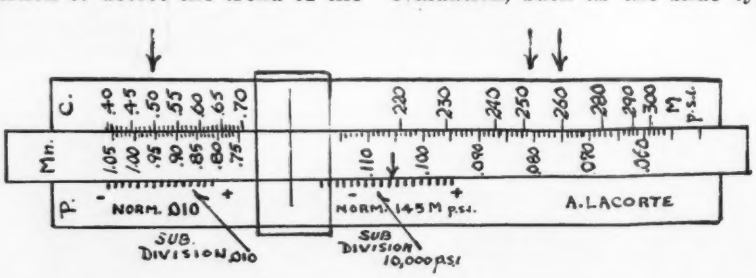
★ ★ ★

In making use of this slide control, one must correlate all the facts and data of acid, inhibitor, coating compound, lime, baking time and temperature, mixture of lubricants, die design, die life, drafts, drawing speeds, chemical analysis, rod and all wire tensiles, and the intermediate and finish gauges. When tranposing this correlated data to a slide control, it is surprising to see such close relationship of these combined materials on a pro-ratio basis. This close relationship is what gives us accurate control.

★ ★ ★

For example continuing with a daily and weekly graph study of the materials, if we should find that our finished wire was not up to standard, we would seek through our graphs a subnormal condition. Let us say that if our acid usage went up 5% above our standard production consumption, we then would suspect a slight degree of hydrogen embrittlement; or, if our soap usage went up and amount of the hydrated lime mixed with soap went down, we would have an increase of scratched wire and decrease in die life. These and many other such conditions would build up the tensiles above our standards. Now as-

(*Please turn to page* 504)



Government Wire Production Information

Report on New Alloy Developments

Processes for producing new corrosion and high temperature-resistant alloys are described in a group of Government research reports reviewed in the March issue of the Bibliography of Technical Reports just published by the **Office of Technical Services, U. S. Department of Commerce.** Among the significant developments described in this issue of the Bibliography are the following:

★ ★ ★

Development of Titanium-Base Alloys. Battelle Memorial Institute. Progress report covering the period July 1 to Aug. 31, 1950. Aug. 1950. 22 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $2.00, Photostat $3.75. Progress is reported in the development of a titanium-base alloy. Tensile properties were obtained on the titanium-molybdenum, titanium-iron, and titanium-vanadium series. Corrosion tests in sea water and in a humidity chamber indicate that unalloyed titanium and the 3% Cr. 1.5% Fe, 0.1% N alloy are more resistant to attack than 24ST Alclad and Monel. Creep-rupture tests are continuing at 600°-1100°F on Ti-Cr-Fe-N alloy, and preliminary welding tests of this alloy have shown that it is capable of being spot welded and flash welded. Code No. of Report, PB 108091.

★ ★ ★

Development of Titanium-Base Alloys. Battelle Memorial Institute. Progress report covering the period Sept. 1 to Oct. 31, 1950. Oct. 1950. 38 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $2.25, Photostat $5.00. Progress made in the evaluation of exploratory titanium-base alloys, and the 3% chromium, 1.5% iron, 0.1% nitrogen alloy is described. Some very interesting tensile properties are reported for a series of chromium-iron ternary alloys con-

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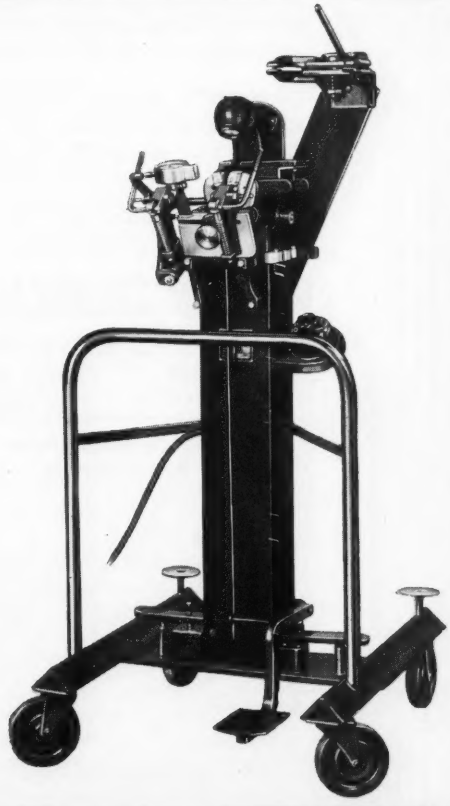

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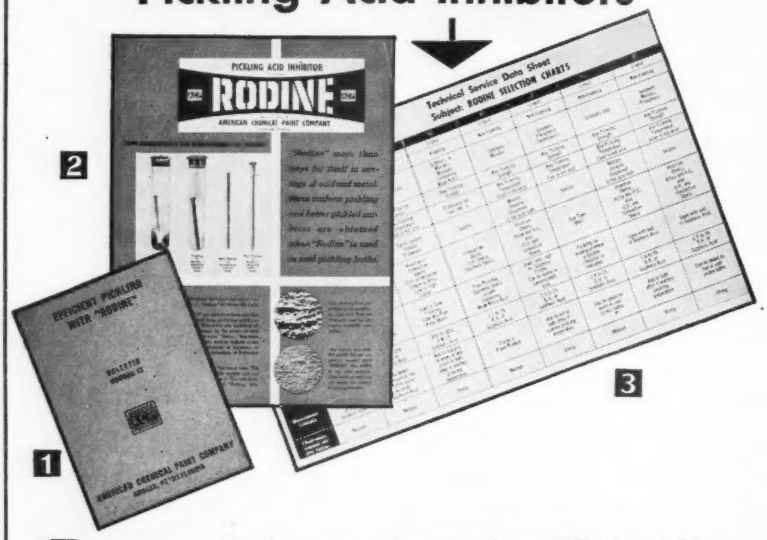

1 The standard reference work on pickling, "Efficient Pickling With RODINE" — Bulletin Number 13 — is now available in a new, revised edition.

2 This new 4-page general descriptive folder presents essential information on "Rodine" pickling acid inhibitors.

3 The recently revised "RODINE SELECTION CHART" gives characteristics of and uses for typical "Rodines" used with sulfuric and muriatic acids. Technical Service Data Sheet No. 13-1-1-4.

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taining up to 5% chromium and 2% iron. Chapters: Arc-melting of titanium-base alloys; Evaluation of experimental titanium-base alloys; Corrosion properties; Stress-rupture properties. Code No. of Report, PB 108092.

★ ★ ★

Development of Titanium-Base Alloys. Battelle Memorial Institute. Progress report covering the period Nov. 1, 1950 to Dec. 31, 1950. Dec. 1950. 70 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $3.00, Photostat $8.75. The weldability investigation on the 3% Cr.-1.5% Fe-0 .0% N alloy was completed. Creep-rupture tests of 600°, 800°, 1000°, and 1100°F were also completed. Weldability studies on the 3% Cr-1.5% Fe-0.1% N alloy demonstrated that sound, strong welds can be obtained by spot welding, flash welding and inert-gas arc welding. Spot welding appears to be the most easily accomplished. Failures which took place in the weld metal indicate that obtaining adequate weld ductility is more critical in this alloy than obtaining soundness of strength. A description of the experimental work conducted on exploratory alloys is included. Code No. of Report, PB 108071.

★ ★ ★

Molybdenum Alloys and Protection by Cladding. Battelle Memorial Institute. April 1950. 153 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $6.00, Photostat $20.00. Experimental work is reported, covering 58 different compositions in ten alloy groups, including unalloyed molybdenum, in the form of 0.040-in. strip finish rolled at 1250°C. and annealed ½ hr. at 1100° C. Mechanical properties of the alloys were in general superior to those of unalloyed molybdenum. A summary of the groups investigated, their ranges, and the strongest alloy having adequate ductility in each group, is presented in tabular form. Code No. of Report, PB 108069.

★ ★ ★

Services, Facilities and Materials Required for Investigations and Studies on Synthetic Resinous Materials. Polaroid Corp. Progress report (period Dec. 1, 1950-Mar. 1, 1951). Mar. 1951. 48 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $2.50, Photostat $6.25. Data on the electrical properties of resin C, which has been used to cast test circuits, resistors, capacitors, and ⅛ inch thick discs, are presented. Several catalysts systems were tested, as well as several resins which were investigated for heat resistance at 450° F. Chemical resistance was the subject of other tests. Code No. of Report PB 108166.

★ ★ ★

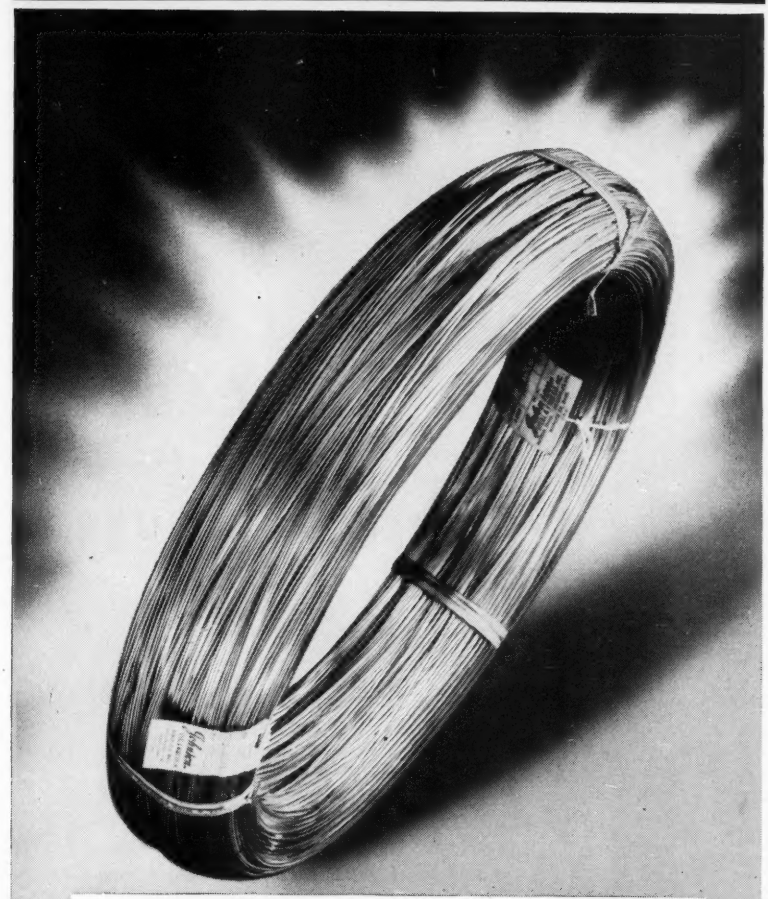
Miniaturized Pulse Cable, for quarter ending Oct. 15, 1952, Nov. 1952. 29 pages. Available from Library of Congress, Publication Board Project, Washington 25, D. C. Microfilm $2.00, Photostat $3.75. Plans for the extrusion of Teflon paste are discussed. The design of machinery required to extrude Teflon paste is reviewed. The application work of semiconducting layers on the conductor and dielectric is examined. The use of Teflon tape as jacketing material is also reviewed. For report No. 1 see PB 107723. Code No. of Report, PB 108437.

★ ★ ★

The March, 1953, issue of the **Bibliography of Technical Reports** sells for $.50 a copy (yearly subscription rate $5.00) and may be purchased from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C. or through the U. S. Dept. of Commerce field offices. Make check or money order payable to the Treasurer of the United States.

New Magnetic Amplifier Makes Better Computers and Servomechanisms

A new magnetic amplifier circuit which makes possible better computers and automatic control systems is described in a group



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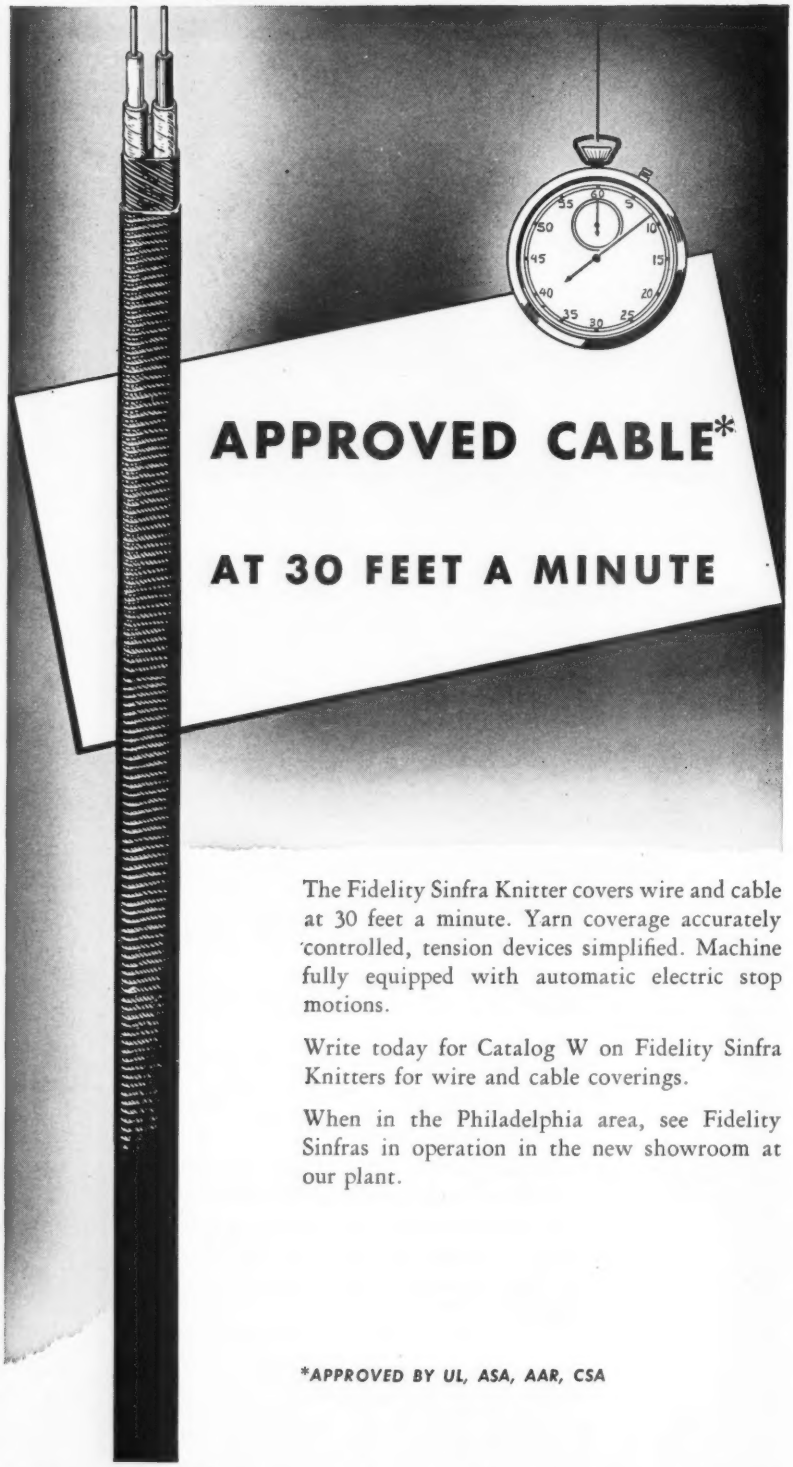

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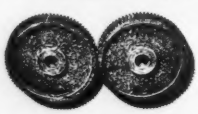

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of three Government research reports now available to the public, the **Office of Technical Services, U. S. Department of Commerce** announced recently.

★ ★ ★

One of the very important characteristics of automatic control systems (servomechanisms) is fast control action (quick response). Magnetic amplifiers are rugged and simple, hence are very desirable for use in automatic control mechanisms, but then generally have slow response actions. Naval Research Laboratory scientists evolved a new theory of the action of magnetic amplifiers, which showed how to make magnetic amplifier circuits of very fast response. They found that these new amplifier circuits also made possible very high power amplification, another characteristic desired in servomechanisms. These new magnetic amplifier control circuits and their characteristics are described in a report by these scientists entitled ON THE CONTROL OF MAGNETIC AMPLIFIERS.

★ ★ ★

Computers also require amplifiers of fast response and high power amplification. In their report entitled THE SINGLE CORE MAGNETIC AMPLIFIER AS A COMPUTER ELEMENT, the NRL scientists show how their new magnetic amplifier circuits can provide more dependable elements than conventional vacuum tube amplifiers in the following basic functional components of computers: coincidence counters, ring counters, and flip-flops. The report also discusses the use of these magnetic amplifier elements in control systems, telemetering systems, and in pulse-modulation monitoring systems as well as in computers.

★ ★ ★

A requirement of many automatic control systems is that they be able to "anticipate" changes in the thing being controlled, so that they can produce the right control action rapidly and without overshoot. How these new magnetic amplifier circuits can be used to

provide such anticipatory correction mechanism is described in another report by the NRL scientists entitled LEAD NETWORKS UTILIZING A SATURABLE CORE MEMORY. The report points out that anticipating correction mechanisms formed from these magnetic amplifier circuits use less power and are much more free of noise than conventional anticipatory correction devices.

★ ★ ★

PB 105747, **On the Control Of Magnetic Amplifiers,** 9 pages. Mimeo $.50.

PB 111033, **The Single-Core Magnetic Amplifier As A Computer Element,** 11 pages. Mimeo $.50.

PB 111022, **Lead Networks Utilizing A Saturable Core Memory,** 12 pages. Mimeo $.50.

★ ★ ★

Orders should be addressed to the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C., accompanied by check or money order payable to the Treasurer of the United States.

More Nickel for the U. S.

Signing of a contract with Falconbridge Nickel Mines Limited, of Toronto, Canada, which will make large additional quantities of nickel available to the United States beginning this year, was announced recently by **Howard I. Young,** Deputy Administrator of the Defense Materials Procurement Agency.

★ ★ ★

The contract calls for production and sale to the United States of at least 100,000,000 pounds of nickel between now and mid-1962, with the possibility of obtaining an additional 100,000,000 pounds by mid-1967. The company will start off with deliveries of at least 2,000,000 pounds by the end of this year.

★ ★ ★

Added to the new supplies of nickel that will come into the United States as a result of other contracts negotiated by DMPA and to the large quantities of the

The above macrograph offers visual proof of the uniform grain flow characteristics in a carriage bolt made from Keystone "Special Processed" Cold Heading Wire. The continuous, strength-giving flow lines are a sure sign of efficient cold heading which results in longer die life, increased production and a better finished product.

The following analysis of "special processed" wire is recommended for difficult cold heading:

C1006 - C1012 for Clutch Heads
C1006 - C1022 for Phillips Heads
C1006 - C1022 for Struck Slot Heads
C1108 - C1109 for Phillips Head Wood Screws
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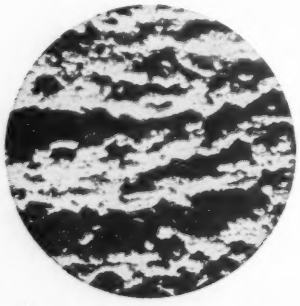
Technical Service Data Sheet

Subject: EFFICIENT PICKLING WITH RODINE®

ADVANTAGES OF "RODINE"

RODINE is used in sulfuric and muriatic acid baths for improved pickling and increased production. It meets Government Specification U.S.N. 51-I-2.

In straight line pickling of wire, rod and tubing, RODINE makes available more metal for drawing by protecting steel from acid attack. In batch pickling of sheet steel, RODINE improves the surface. In rapid, continuous strip pickling, RODINE not only saves acid and metal, but also prevents over-pickling during line shutdowns.



◀ *This steel surface was pickled in an uninhibited acid bath. Note the deep pits, and that the surface is visibly crystalline.*

This surface was pickled exactly like the one above except that "RODINE" was added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred. ▶

CHEMICALS ACP PROCESSES **WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM.** CHEMICALS ACP PROCESSES

metal being produced by the Government - owned Nicaro Nickel Plant in Cuba, the new Falconbridge project will go far toward closing the remaining gap between future supplies and requirements.

★ ★ ★

However, the new contract will not remove nickel from the "most critical" list and still further expansion of production will be sought. Annual U. S. consumption of nickel before Korea was about 200,000,000 pounds, but requirements have skyrocketed since, largely for jet engine production.

★ ★ ★

Under the new contract, the United States also will obtain significant quantities of cobalt from the company—up to 2,000,000 pounds by June 30, 1962—and up to 52,000,000 pounds of refined copper by December 31,1958.

★ ★ ★

In the latter part of 1951, Falconbridge discovered important new nickel-ferrous ore reserves but because of the large capital outlays necessary to bring the properties into production had not planned to undertake their development for some years. However, in view of this country's mounting needs for nickel, the company has agreed to begin development of the properties immediately.

★ ★ ★

The speed-up program will involve an investment of well over $42,000,000. It will be a completely underground operation. Two shafts, one 3,700 feet deep and one 3,500 feet deep, will have to be sunk, together with several other lesser shafts. All necessary milling facilities will have to be installed, and additional smelting and refining capacity will have to be provided. The agreement does not provide for the advance or loan of any Government money.

★ ★ ★

DMPA also has contracts with East Rim Nickel Mines Limited and Milnet Mines Limited, both of Toronto, covering production of over 4,000,000 pounds of nickel. Under both contracts, Falcon-

bridge is the smelting and refining contractor.

★ ★ ★

In addition, DMPA has contracts with the Hanna Coal & Ore Corporation and the Hanna Nickel Smelting Company, subsidiaries of the M. A. Hanna Company, of Cleveland, Ohio, for production of 95,000,000 to 125,000,000 pounds of ferro-nickel (25 per cent nickel, 75 per cent iron) from a deposit in southwestern Oregon, only major known nickel deposit in the Continental United States.

★ ★ ★

The Nicaro plant in Cuba is now producing at an average rate of over 2,000,000 pounds of nickel oxide per month.

Price Controls End

Price controls are ended.

★ ★ ★

OPS Director **Joseph H. Freehill** announced in March the lifting of all remaining price ceilings.

★ ★ ★

In Amendment 1 to General Overriding Regulation 44, OPS exempted from price control all sales of all commodities and services. The exemption is applicable in the Continental United States, in the Territories and possessions and in the Commonwealth of Puerto Rico.

★ ★ ★

This action is the seventh and final step in compliance with the President's direction for orderly termination of price controls.

★ ★ ★

Previously, over a period of several weeks beginning February 6, 1953, OPS had issued orders gradually removing from price control a wide range of commodities and services. On March 12, the agency issued General Overriding Regulation 44, which removed price control from all commodities and services except a limited number of items in the chemical and industrial materials field.

★ ★ ★

In the industrial materials field, iron and steel mill products, pig

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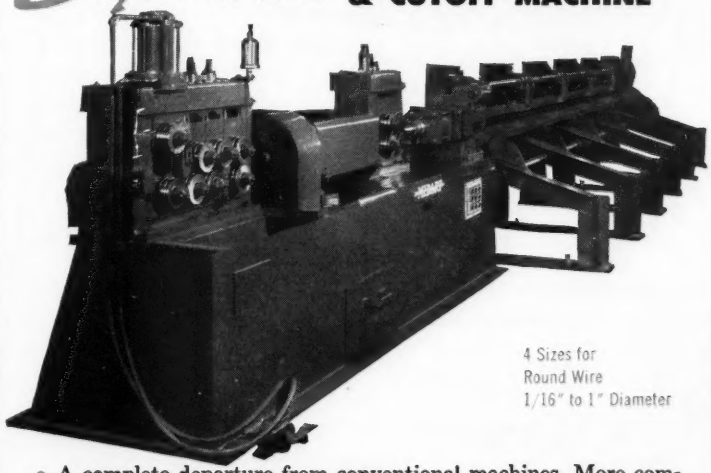

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- A complete departure from conventional machines. More compact and accurate, with throughput speeds to 200 f.p.m. depending upon size and type of material.
- Fully automatic feed-through, straightening and cutoff, without attention from operator, after end of coil is started through pinch rolls.
- All swelling or expansion of workpiece is prevented by new HYDRA-ELECTRIC AUTOMATIC CUTOFF. Electronic self-actuating shear eliminates all mechanical operating parts beyond Cutoff. Makes up to 60 cuts per minute.
- Exclusive ROTO-DIE SPINNER is equipped with cylindrical straightening dies mounted in anti-friction bearing, instead of ordinary cast iron shoe-type dies. Virtually all friction, heat and rapid die wear are prevented. Protects against changes in physical characteristics and surface of wire.
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- Rugged construction. Timken bearings throughout. Ground and polished Smavroc steel rolls. All mechanism completely accessible for maintenance.

Supermatic fully automatic two-plane models for wire shapes other than round also available.

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- ☐ Cable
- ☐ Car Seal
- ☐ Core
- ☐ Cotter Pin
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iron, ferro alloys, beryllium master alloys, beryllium oxide and beryllium mill products; monel, inconel and nickel primary shapes including anodes; monel, inconel and nickel mill products and nickel base alloys and mill products; columbium; tantalum; molybdenum; steel shipping containers; metal cans; fabricated structural steel, miscellaneous and ornamental iron, and vessel shop products for field assembly and erection; concrete reinforcement bars and materials; machine tools; and cutting tools used in or with machine tools.

★ ★ ★

The annual sales volume at the producer or manufacturer level of the commodities removed from price control by this action is approximately $15.6 billion.

★ ★ ★

In addition to setting aside all remaining ceiling price regulations, the decontrol order also has the effect of terminating the voluntary agreements most steel producers entered into with OPS covering price controls on their products.

★ ★ ★

OPS officials emphasized that today's order has no effect on standing requirements calling for the preservation of records of past transactions for specified periods.

★ ★ ★

Business firms need not make or keep records on future transactions but must keep available for inspection whatever records were required by the regulations under which they formerly operated. April 30, 1955, has been specified as the latest date beyond which records need not be retained.

★ ★ ★

The period of retention may be shorter for certain businesses and certain records.

★ ★ ★

For detailed information on records-preservation requirements, businessmen are advised to consult the regulations which have been covering them.

ABSTRACTS

INDUCTION HEATING FOR BOLT HEADING.

(Metal Treatment and Drop Forg., 1952, 19, May, 227-228).

Birlec Ltd. have recently developed a range of standardized induction-heating machines for bolt 'pins.' Stock sizes ranging from ½ in. to 1¼ in. in dia. can be accommodated, and the rate of delivery of heated pins can be adjusted up to a maximum output of 1500/hr./-machine.—P.M.C.

★ ★ ★

WIRE ROPE LUBRICATION.

C. H. Layton. (Iron Steel Eng., 1952, 29, Sept., 167-171).

The author stresses the need for wire rope lubrication and distinguishes between lubrication while the wire rope is being made and the proper lubrication of the wire rope in service, and describes how these operations are carried out.—M. D. J. B.

★ ★ ★

RESIDUAL STRESSES IN SPRINGS.

O. G. Meyers. (Product Eng., 1952, 23, July, 148-149).

Longer life and increases up to 30% in the maximum allowable working stress can be obtained if residual stresses are controlled. Stress relief and cold setting are two controlling factors and the effects of these are briefly discussed.—A. M. F.

★ ★ ★

PROBLEMS IN CONNECTION WITH THE DRAWING OF STEEL WIRE.

C. O. von Hofsten. (Värm. Bergsmann., 1951, 32-53). [In Swedish.]

Patenting gives a mixture of fine lamellar pearlite and bainite with good cold-working properties. If the period in the cooling bath is insufficient, residual austenite will change to martensite, giving a brittle wire. Diagrams show carburization and decarburization among test pieces annealed simultaneously under producer gas at 680° C. It is stressed that gas composition must be closely balanced.

★ ★ ★

COLD FINISHED CARBON STEEL BARS.

(Amer. Iron Steel Inst., Steel Products Manual Section 9, Sept., 1952).

This 78-page booklet makes available to purchasers, producers, and consumers information on manufacturing practices, quality descriptions, sizes produced, and properties of cold-finished steel bars manufactured in the U.S.A.—R. A. R.

★ ★ ★

WIRE GUARDS.

D. R. Woodley. (Wire Production, 1952, 1, Sept., 18-22).

The author deals with window and machinery guards designed to prevent accidents and vandalism. Design of guards, both technical and artistic, method of construction, and choice of wire mesh are discussed.—J. G. W.

★ ★ ★

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1 GREATER SALES APPEAL!

Gray Soldura gives the buyer visible evidence that the flame-proof compound on non-metallic sheathed cable and service entrance cable is completely sealed and covered. Moreover, it camouflages service entrance cable used on white houses and forms an excellent base for the subsequent application of house paint.

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Gray Soldura *looks* cleaner because it *is* cleaner. It's used with a clear wax top dressing (which makes it easier to pull through joists or fish through conduits) and will not mark up walls during installation. Workmen's hands stay cleaner, too.

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Actual laboratory tests have shown that gray Soldura, applied with a proper saturant and finish, will prevent sticking at temperatures as high as 140°F. and will not flake off under freezing conditions.

FOR GREATER SALES APPEAL... FOR CLEANER APPEARANCE, EASIER HANDLING, AND FREEDOM FROM STICKING OR FLAKING... USE SOLDURA... THE GRAY WIRE COLOR SOLUTION THAT BUILDS SALES.

SPECIFICATIONS*

Weight per gallon	15-16 lbs.
Total solids	75-80%
Viscosity, Gardner Mobilometer @ 77°F., 250 grams load	15-20 seconds
Estimated coverage—Sq. Ft. per gal.	1250-1500
Number of coats recommended	Two, for best results
Colors	Light, medium and dark gray

**Gray Soldura is soluble in alcohol, acetone, and common lacquer solvents, but is not soluble in gasoline and petroleum solvents.*

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Solar Varnish Corporation
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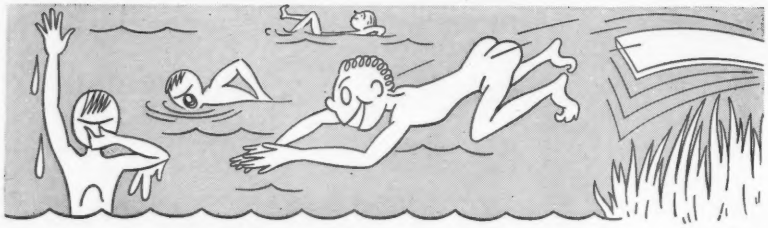
1213 WEST BLANCKE STREET • LINDEN, N. J.



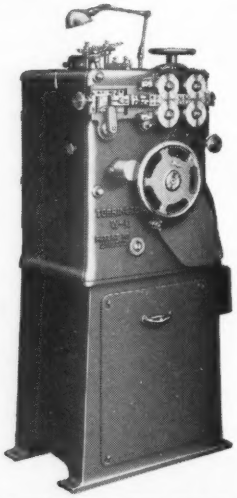
When a good spring will be a tonic

for your business, see the man with a

Versatile Torrington Spring Coiler

In spring coiling, the words "Torrington" and "Versatile" are synonymous! When you desire springs produced to meet exacting requirements, just call the professional springmaker who has a Torrington coiler. He's the man who can fill your needs with accuracy, speed and economy. On special springs, our sales department will gladly assist you in finding a source of supply, or help your springmaker devise just the right tooling to produce it.

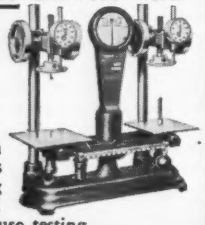
Torrington's 14 different Spring Coilers cover a range of wire diameters from .003" to .750"



MODEL W-11 SPRING COILER

Wire diam. range: .015" to .072". Length per spring: 0" to 42". O. D. Coil Range: 3/32" to 1 9/16". Produces 23 to 190 springs per minute with variable speed drive. Extra wire feed gears, torsion, other attachments available.

NOW... Spring Makers and Users can get the same answers with The TORRINGTON SPRING TESTER



An accurate, uniform and inexpensive means of measuring spring load and deflection! For inspection or in-use testing . . . to aid in designing and developing springs for specific uses or as a basis for statistical quality control. Write today for illustrated bulletin on the Torrington Spring Tester!

The TORRINGTON MANUFACTURING COMPANY TORRINGTON, CONNECTICUT

ELECTROPLATING STEEL SPRINGS. (Metal Ind., 1952, 81, Aug. 29, 167, 168).

Recommendations are made by the Coil Spring Federation Research Organization covering the principles which should be observed in the cleaning and electroplating of hardened and tempered steel springs, or of springs made from cold-worked steels, having in view the need for avoiding loss of ductility in the final product. The recommendations aim at avoiding hydrogen embrittlement. — P. M. C.

★ ★ ★

THE STANDARDIZATION AND TESTING OF WIRE-DRAWING DIES. A. Pomp (Schweiz. Archiv angew. Wiss. Techn., 1952, 18, (3), 97-101).

Provisional German specifications for sintered-carbide wire-drawing dies are discussed. For lubrication with dry soap there is a single cone on the entry side of the bearing to ensure that the lubricant is forced against the surface of the wire in the wedge between the profiles; with liq. lubricants, it is necessary to allow greater access to the die hole and a second, wider cone on the entry side is included in the design. Methods of measuring the internal dimensions and checking the profiles of dies are discussed. Feeler and opt. devices are described, particular attention being paid to the "Alfameter" and the images produced in this instrument by dies with perfect profiles and those with various kinds of defect: curvature of the conical profile is revealed by diffuseness of the ring, lack of concentricity is immediately obvious, and longitudinal draw marks in the die result in radial lines in the image.

Steel Co. of Canada's Sales Highest in History

The Steel Company of Canada achieved new high records of ingot production and net sales to customers in 1952. The company's 1952 sales totaled $190,214,161, nearly 10 million more than in 1951.

★ ★ ★

Ingot production last year was 1,371,789 tons, a 9% increase over 1951 production of 1,255,227 ingot tons. The company rolled 1,817,757 tons of ingots in the year, 16,308 tons more than 1951. The total includes ingots purchased and received from customers for conversion.

★ ★ ★

Investment in plants and properties during the past year totaled $42,200,000, mainly applied toward completion of the company's program to step up ingot capacity by 50%. In the ten years 1943-52 inclusive, the total net investment in additions and improvements in fixed assets has amounted to $107,378,370, and outlay of $18,000,000 more is required to round out the present program.

Outstanding Personalities of the Wire Industry

Executives Advanced By A. S. & W.

Two executives of **American Steel & Wire Division** have been promoted to new posts, according to an announcement by **Van H. Leichliter,** vice president of operations of this division of United States Steel Corporation.

★ ★ ★

In the moveup, **Richard R. Snow** has been named assistant to vice president of operations with headquarters in Cleveland, and **John P. Debri** has been appointed general superintendent of the Wire Division's Joliet plant.

★ ★ ★

Mr. Debri succeeds Mr. Snow who leaves his Joliet post to succeed Burton H. Gedge who is retiring after 42 years of service.

★ ★ ★

In his new post Mr. Snow is responsible in a staff capacity for American Steel & Wire "hot" operations in its 14 mills in nine cities spread from Duluth to Trenton. This includes open hearths, rolling mills and rod mills.

★ ★ ★

Born in St. George, Maine, in 1907, Mr. Snow received his education at Colby College, the U. S. Naval Academy, and at Massachusetts Institute of Technology, earning his B.S. Degree in Mechanical Engineering.

★ ★ ★

He began his career with American Steel & Wire as a millwright helper at Worcester, Mass., in 1933. He became a foreman in the blooming mill in 1936 before being transferred to the Cleveland office. After a year he returned to Worcester as assistant superintendent of the open hearth and rolling mill. He again came to the Cleveland offices as division metallurgist in 1941. In 1944 he was made division superintendent of the hot mills in Joliet and became general superintendent in October of 1947.

★ ★ ★

Mr. Debri, who formerly was division superintendent of the Joliet wire mill, climaxes a 45-year success story which began when he joined American Steel & Wire at Joliet Works as a messenger boy in 1908. Working days, while attending night school, he progressed through the ranks in various accounting positions and was made general superintendent's clerk in 1937.

★ ★ ★

His advancement continued in 1941 when he was appointed to superintendent of the former

Glader-Years of Proven Performance
GLADER NAIL MACHINES
55 YEARS of experience meeting the exacting demands of nail making.
The machine with a record of steady dependable service.
Wm. GLADER MACHINE WORKS
210 N. RACINE AVENUE
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Rockdale Works. A year later he was made superintendent of the combined Rockdale and Scott Street operations and in 1943 was named assistant division superintendent of Joliet Works wire mill. He was appointed division superintendent there in 1945. He is a member of The Wire Association.

★ ★ ★

Becomes Officer of Hooker

R. W. Murray, president of **Hooker Electrochemical Company,** announced in March that **R. Wolcott Hooker,** formerly vice-president in charge of sales, has been elected to vice president and has been given broader responsibility with respect to overall management of the company. Among his other duties, Mr. Hooker will continue to be active in sales work. **Robert E. Wilkin,** formerly general sales manager, was elected vice-president and general sales manager, while **Frank W. Dennis,** formerly director of industrial relations, was elected vice-president in charge of industrial relations.

At the same time it was announced that **Harry W. Bryson, Jr.** has been appointed sales service representative of Hooker Electrochemical Company at Tacoma, Washington, handling caustic soda, chlorine and ammonia. His territory includes the Pacific Northwest states, British Columbia and Alaska.

★ ★ ★

He has been employed by Hooker since 1950 in the process study group; is a veteran of World War II and was graduated from Washington State College with a B.S. in chemical engineering in 1942.

★ ★ ★

Standard Industrial Compounds Elects Officers and Authorizes Plant Improvements

On March 10th, the Annual Stockholders' Meeting of the **Standard Industrial Compounds Company** was held at the company's offices in Chicago. **Bruce Siemon, Earl Bowers** and **John Moritz** were elected new members of the Board; **Floyd M. Hauger** and **Charles P. Orr** were re-elected members.

★ ★ ★

Afterward, at a meeting of the Board of Directors, all the present officers were re-elected. Expenditures were authorized for installation of a new sprinkling system and a new automatic cooking equipment leading to better efficiency and more uniform products. A new system was approved for better control of manufacturing and inspection.

★ ★ ★

Joseph Beegle, Chief Chemist, was given full control of manufacturing and inspection, relieving Mr. Hauger of these responsibilities; Mr. Hauger's duties will now be largely administrative, but he will still retain general management of all company activities, manufacturing, inspection and development of new products.

★ ★ ★

The company looks for con-

M R+P
SINCE 1870
A New Universal Automatic Multi-Slide Bending Machine
suitable for the fully automatic, economical mass production of all types of components from wire and strip material.
Special Features:
• Vertical, enclosed construction, requiring the minimum of floor space.
• Positive and direct control of the bending slide, ensuring high output and trouble-free operation.
• Accurate material infeed by special gripping mechanism.
• Simple tooling, easily adjusted and changed.
• Additional slides for special shapes can be fitted.
• Extra attachments for piercing, blanking and embossing.
Our special leaflet giving details on the range of application of our automatic multi-slide bending machines is available on request.
MEYER, ROTH + PASTOR
MASCHINENFABRIK G.M.B.H.
KÖLN-RADERBERG / GERMANY

tinued good business throughout the year 1953.

★ ★ ★

Appointments at Donora

Donora Steel & Wire Works, Donora, Pa., American Steel & Wire Division, U. S. Steel Corp., has appointed **Joseph J. Just** as assistant to general superintendent. He succeeds **Charles Witherspoon,** retired. Mr. Just, who has been division superintendent, wire and wire products, is replaced by **John T. McHugh.**

★ ★ ★

Dwight Palmer Retires

Dwight Palmer has retired as chairman of **General Cable Corp.,** New York, and is succeeded by **Irving T. Bennett,** who on May 1 will also be chairman of the executive committee. Mr. Bennett was vice president of Revere Copper & Brass Inc. On Nov. 1 he will become chief executive officer of General Cable. **James R. MacDonald,** president, will continue in that post, and will assume charge of all company operations.

Made General Sales Manager of Naugatuck Chemical Division

Harold M. Parsekian, formerly sales manager for Marvinol vinyl resins, has been appointed sales manager for all plastics manufactured by the **Naugatuck Chemical Division, United States Rubber Company, George R. Vila,** general sales manager, announced recently.

★ ★ ★

In his new capacity, Mr. Parsekian will supervise sales for Marvinol vinyl resins, Kralastic styrene co-polymer molding and extrusion powders, Vibrin polyester resins, and other plastic raw materials manufactured by the division.

★ ★ ★

A graduate of Cooper Union with a bachelor's degree in chemical engineering, Mr. Parsekian joined Naugatuck Chemical in 1950 when U. S. Rubber purchased the assets of the chemical division, Glenn L. Martin Co. He had been director of sales and technical service for the chemical division of the Martin Company.

Ipsen Retires From G-E to Take IFMA Post

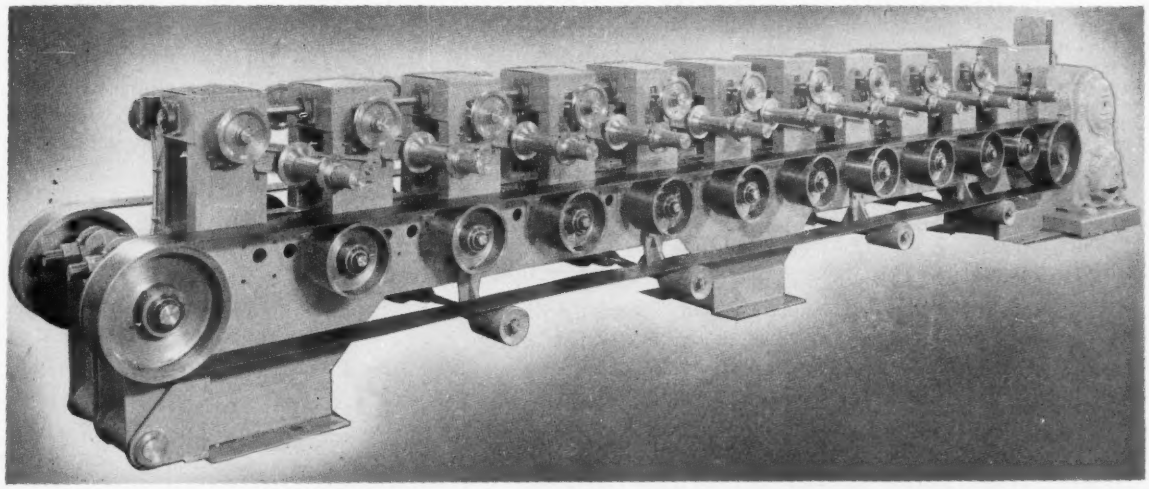
Carl L. Ipsen has retired from the **General Electric Company** to become executive vice president of the Industrial Furnace Manufacturer's Association in Washington, D. C.

★ ★ ★

Mr. Ipsen, who has been with G-E for 39 years, served as manager of the company's industrial heating department from 1947 until 1951. He then became chief of the industrial heating equipment section of the National Production Authority. During the past year he has acted as chief consultant for the G-E heating department.

★ ★ ★

A native of Randolph, Kansas, Mr. Ipsen was graduated from Kansas State College with a B.S. degree in electrical engineering, joining G-E in 1913 on the test program at Lynn, Mass. In 1917 he was made sales engineer of the company's Buffalo, N. Y., office.



20-UNIT WIRE TAKE-UP

Similar models for smaller reels or less number of units.

VARIABLE-SPEED BELT TYPE, FOR 12" AND SMALLER DIAMETER REELS.
MOTOR DRIVEN AND BALL-BEARING MOUNTED THROUGHOUT.
REEL SPINDLES STOPPED INDIVIDUALLY BY RAISING-LEVERS.
REEL RETAINERS WITH QUICK-ACTING LOCK AND RELEASE.
TRAVERSE ADJUSTABLE FOR WIDTH AND RATE.

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"American" INSULATING MACHINERY COMPANY
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FAIRHILL AND HUNTINGDON STREETS
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Sheet & Tube Shifts Personnel

Donald W. Lloyd, general superintendent of Brier Hill Works, **Youngstown Sheet & Tube Co.,** has been made general superintendent of the company's steel plant at Indiana Harbor, East Chicago, Ind., to succeed the late **George W. Abel, Thomas B. Carpenter** succeeds Mr. Lloyd, and is replaced by **James W. Kirkpatrick** as superintendent, Brier Hill open-hearth department. **Ernest B. Plott** becomes chief metallurgist in the Youngstown district.

Changes at J. & L.

W. A. Morris Jr., formerly director of purchases, was recently named to the new post of vice president of purchases at **Jones & Laughlin Steel Corp.,** Pittsburgh, and was also named to the management committee. **J. W. Lindsey** was made general purchasing agent; **A. N. Johnston,** formerly purchasing agent, was named assistant to the vice president-purchases; and **C. L. Brinker** appointed assistant general purchasing agent-raw materials. **H. W. Graham,** formerly vice president-technology, becomes vice president-research and **D. T. Rogers** director of technical services.

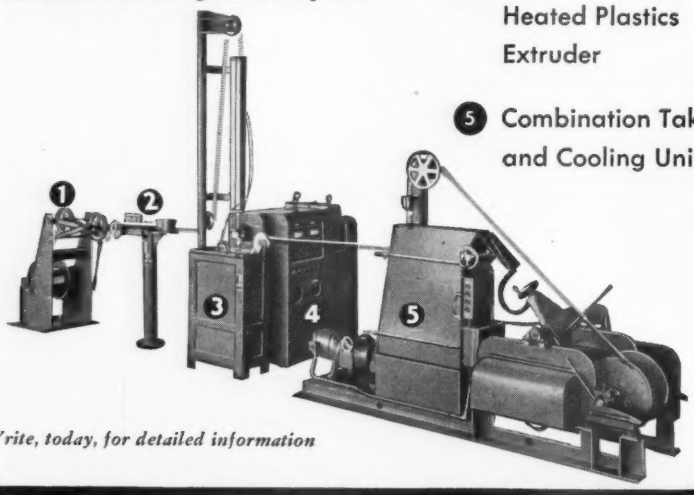
NRM

COMPLETE EQUIPMENT FOR COVERING WIRE WITH NYLON . . . . . .

Here's a "straight-line" production unit especially designed to give you faster, better covering of wire with Nylon. From the sturdy supply stand to the combination take-up and cooling unit, this NRM equipment is tailor made to give you the maximum output of accurately centered, smoothly covered wire at a minimum of cost and maintenance. A special metering type "torpedo" feed screw, a special Nylon crosshead, and extremely uniform heating are combined in a rugged 1½" electrically heated extruder to eliminate "pulsation" and to cover small gauge wire at high speeds and to close tolerances.

What's more, with a few simple changes this same equipment can be used with other wire covering plastics. The extruder, with built-in "Balanced Heat Control", need only be fitted with a different feed screw to handle a wide range of thermoplastics.

1. Supply Reel Stand
2. Wire Straightener
3. Vertical Wire Preheater and Cooling Tank
4. 1½" Electrically Heated Plastics Extruder
5. Combination Take-up and Cooling Unit



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2018

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Creative Engineering

Crucible Appoints Chief Metallurgist at Midland

L. L. Ferrall, director of metallurgy for **Crucible Steel Company of America,** has announced the appointment of **Julian D. Dickerson** as chief metallurgist for Crucible's Midland, Pa., works. He replaces George Bryer, who was recently appointed metallurgist service engineer for the Detroit area.

★ ★ ★

Previous to joining Crucible, Mr. Dickerson was chief metallurgist for Republic Steel at its Buffalo plant. He joined Republic, in Buffalo, in 1933 and worked in the open hearth and metallurgical departments. He was appointed chief metallurgist in 1940.

Named to New Research Posts at J. & L.

Jones & Laughlin Steel Corporation has announced the recent promotion of two men engaged in research activities for the corporation.

★ ★ ★

Dr. Harold T. Clark, formerly manager of metallurgical research, was named to the position of assistant director of research. He will have responsibility for supervision of all divisions of research for J. & L.

★ ★ ★

George H. Enzian, formerly assistant manager of metallurgical research, was moved up to manager of metallurgical research.

★ ★ ★

A graduate of Lafayette College, Dr. Clark received his Doctors' degree in Physics from Purdue University and began his service with J. & L. in 1936 as a research engineer. He became manager of metallurgical research in 1948.

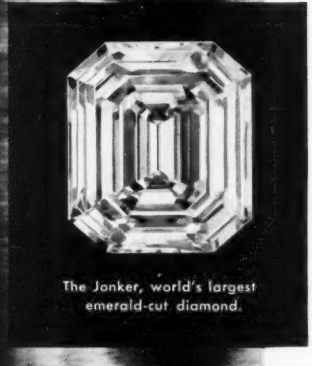
★ ★ ★

Mr. Enzian was graduated from Lehigh University and took graduate metallurgical studies at Carnegie Institute of Technology. He started with J. & L. in 1935 as a metallurgical inspector and was

Here is perfection!

ROEBLING makes the finest high carbon wire available to industry today. Roebling wire is absolutely true to specifications... absolutely uniform in gauge and finish. Manufacturers who try Roebling wire once, become Roebling customers from then on.

You *pay* for the best when you buy high carbon wire. Make sure that you *get* it! Always specify Roebling. John A. Roebling's Sons Corporation, Trenton 2, N. J.



The Jonker, world's largest emerald-cut diamond.

ROEBLING CF&I

A subsidiary of The Colorado Fuel and Iron Corporation

BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

Three Steps to Success in the WIRE INDUSTRY

YOUR PRODUCTS FALL INTO ONE OF THESE CATEGORIES.

USE "WIRE AND WIRE PRODUCTS" TO SELL WHAT YOU MAKE.

RODS and WIRE

There are 143 plants producing bars, billets and rods, most of which also draw wire.

Such concerns can sell their products to others who purchase rods and wire for redrawing and for the fabrication of wire products.

497 concerns draw wire from purchased rods or wire to be re-drawn to smaller gauges.

All concerns who produce ferrous or non-ferrous billets, rods and wire to sell will find a ready market through the advertising pages of WIRE AND WIRE PRODUCTS, the wire industry's one and only paper, serving this field exclusively.

MACHINERY and EQUIPMENT

Machines wear out and become obsolete. To keep abreast of technical developments, replacements must be made continuously, to say nothing of the demand occasioned by plant expansions.

You can assure your company of first consideration by keeping your customers advised of your products and improvements by consistent advertising in WIRE AND WIRE PRODUCTS.

SUPPLIES and SERVICES

If you are selling lubricants, coating compounds, inhibitors, dies and the like—or even engineering services—the industry will know where and to whom to turn in time of need if you will keep them informed by advertising these products and services in WIRE AND WIRE PRODUCTS.

Advertise to build customer acceptance and good-will——and to get orders.

Full information on advertising rates and circulation is available upon request. Send for information today.

ADVERTISING DEPARTMENT

WIRE AND WIRE PRODUCTS

453 Main Street -:- **Stamford, Conn.**

named to the position of assistant manager of metallurgical research in 1949.

New Research Head for U. S. Rubber

Dr. Leland M. White has been appointed assistant director of the research and development department of **United States Rubber Company,** according to an announcement by Dr. S. M. Cadwell, director of the department.

★ ★ ★

Dr. White joined the company's research and development department in 1940, and has been head of the rubber applications department at the Passaic, N. J. general laboratories since 1947. He is succeeded in the latter position by Dr. B. C. Barton.

★ ★ ★

A native of Kansas, Dr. White was graduated from Ottawa University, and later received his M.A. and Ph.D. degrees at the University of Kansas.

Made Works Manager of C. F. & I.'s Claymont Plant

George W. Bruce has been appointed Works Manager of the Claymont Plant of the **Colorado Fuel and Iron Corporation** at Claymont, Delaware, according to **J. J. Martin,** Vice President In Charge of Operations, Colorado Fuel and Iron Corporation.

★ ★ ★

Mr. Bruce has been associated with the steel industry for the past 22 years. Prior to joining Colorado Fuel and Iron, he held positions with Midvale Steel Company and United States Steel Corporation, and with the Steel Company of Canada as Assistant Works Manager at Hamilton, Ontario.

★ ★ ★

The Claymont plant is one of 12 plants in seven states operated by Colorado Fuel and Iron, the nation's ninth largest steel producer.

Vice President, Research, by American Brass

Arthur H. Quigley, chairman of the board, has announced the appointment of **John R. Freeman, Jr.,** as vice president of metallurgy and research of the **American Brass Company.** In his new position, Mr. Freeman will supervise all metallurgical research projects in all of the company's branches.

★ ★ ★

Mr. Freeman is a native of Winchester, Mass., and a graduate of the Massachusetts Institute of Technology in 1916. He served for 15 years in the National Bureau of Standards, Division of Metallurgy. He joined the technical department of the American Brass Company and in 1934 was made assistant manager. He became technical manager in 1938.

Appointed Manager of A. C. & C.'s Adrian Plant

Arthur H. Kapnick was recently appointed manager of the **American Chain and Cable Company's** Adrian, Mich., plant. At this plant, their Automotive and Aircraft Div., aircraft cable, fittings, controls and other products are manufactured.

JLE

SERVING THE WIRE INDUSTRY THROUGHOUT THE WORLD

- Caterpillar Pull-outs
- Standard Sets of Spark-Testing Equipment
- Take-ups and Re-spoolers
- Reelers
- Coilers
- Spoolers
- Collapsible Coiling Reels
- Wire Sparkers and Accessories
- Hand Locators
- Electrode Units and Stands
- Measuring Machines, Counters and Accessories
- Wire Guide Units
- Pay-off Reels Stands
- Electronic Devices
- Shaftless Take-ups and Payoffs
- Wire Pre-Heater
- Disk Brakes and Controls, Drag Units and Slip Clutches
- Wire Marking Machines, Type Strips, Inks
- Labelling Machines
- Pneumatic Equipment and Controls
- Special Machinery for the Wire Industry
- Hydraulic Equipment and Controls
- Hi-Pot Test Sets
- Cable Handling Equipment for Warehouse Use

See Page 454 for News of JLE "Caterpuller"

JAMES L. ENTWISTLE CO.

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Beryllium Corporation Re-elects Donachie and Names Other Officers and Directors

The annual meeting of the stockholders of the **Beryllium Corporation** was held on March 24th, the following directors were elected:

Matthew J. Donachie, Maurice A. Hallam, Frederick B. Hufnagel, Richard M. Quimby, Daniel D. Schwartz.

★ ★ ★

The stockholders at this meeting approved an amendment to the certificate of incorporation eliminating the authorized 5,000 shares of preferred stock, all of which has been retired. The authorized common capital stock was increased from 200,000 shares to 800,000 shares all of which shall be of no par value.

★ ★ ★

At the reorganization meeting of the board of directors the following officers were elected:

Daniel D. Schwartz, chairman of the board; Matthew J. Donachie, president; William D. Gamon, vice president; Richard M. Quimby, secretary and acting treasurer.

Made Manager of Australian Mill

Frank Jenks, formerly Assistant Manager of the **Newcastle Wire Mills of Rylands Bros.** (Aust.) Pty., Ltd., has been selected for the post of manager to replace **J. K. MacDougall,** who retired recently.

★ ★ ★

Mr. Jenks has had a lifetime of experience in the wire industry, having been with Rylands Bros., Ltd., of Warrington, England, before he came to Australia in 1921. He has been closely associated with the technical development of the Australian firm since he joined its staff.

Acheson Announces New Appointments

The Acheson Colloids Company, Division of Acheson Industries, Inc., Port Huron, Mich., recently announced five new executive appointments. The Acheson company manufactures colloidal graphite dispersions.

★ ★ ★

Harold J. Dawe, Director of Product Development, has been appointed Technical Director. He will be responsible for all research and development activities of the company.

★ ★ ★

Alden Crankshaw has been named Sales Manager for Acheson Colloids, and is now located in the main offices at Port Huron. He has been an Acheson Service Engineer for 21 years, working out of the company's New York sales office. Mr. Crankshaw's New York and New Jersey territory will now be served by **Paul E. Yoder.**

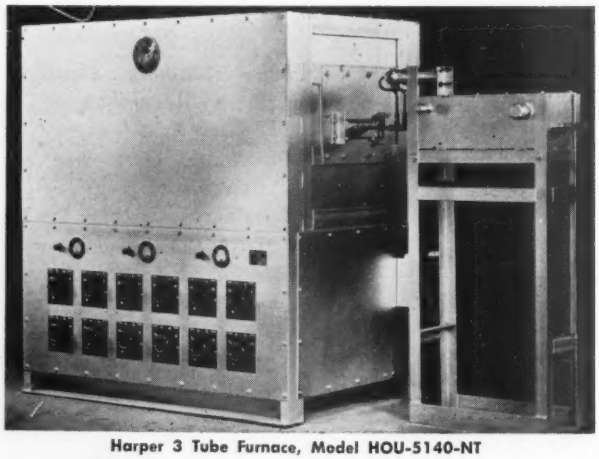
★ ★ ★

John W. Shier, Acheson Plant Engineer since 1949, has been named Production Manager.

★ ★ ★

The new supervisor of Acheson's product development laboratory is **Earl L. Youse,** who joined the company in 1952.

ECONOMICAL, EFFICIENT WIRE STRAND ATMOSPHERE ANNEALING WITH HARPER ELECTRIC STRAND ANNEALER



Harper 3 Tube Furnace, Model HOU-5140-NT

Using one of these HARPER Annealers, a customer reports satisfaction, stating that its advantages to them are:

1. "Exceptionally uniform temperature throughout the entire heating zone;"
2. "Reliable trouble-free operation."

This furnace is used for annealing a high alloy stainless steel wire at temperatures of from 1750°F. to 2300°F., with the wire moving through at a speed of 8 FPM.

Such Continuous Strand Annealers are available in various sizes, with from 3 to 60 tubes in capacities to fit your requirements.

You are invited to consult Harper Engineers on your wire problems. Address inquiries to Dept. 12.

HARPER ELECTRIC FURNACE CORP.

Dept. 12, 39 River Street, Buffalo 2, N. Y.

Designers and Builders of High Temperature Electric Furnaces

American Brass Names Vice President

John R. Freeman Jr. has been appointed vice president of metallurgy and research of the **American Brass Company,** Waterbury, Conn. He was formerly technical manager of the company.

Canadian Wire Man Retires

J. H. Fraser, who has been general superintendent of **Dominion Iron & Steel Ltd.,** Sydney, N. S., for 23 years, in March retired from active association with the company.

Blaw-Knox Appoints Sales Manager

William Rodgers of Pittsburgh has been named general sales manager of **Blaw-Knox Company,** effective April 1, it was recently announced by **W. Cordes Snyder, Jr.,** president.

★ ★ ★

This is a new staff post, Mr. Snyder said, and Mr. Rodgers will coordinate sales activities for all divisions of the company, as well as assist in developing sales objectives, policies, and programs.

J. & L. Arrives at Century Mark

Jones & Laughlin Steel Corporation is celebrating its 100th anniversary this year with its seven-year, $415,000,000 plant improvement and expansion program nearly completed, shareholders and employees of the corporation were told in the company's 1952 annual report.

★ ★ ★

All phases of J&L operations, from production of raw materials to finished steel are affected. Steel ingot capacity has increased 35% to 6,406,000 tons per year, increasing materially the production of products needed for defense purposes.

Pheoll P. A. Retires Successor Appointed

Retirement of **A. A. Schmid,** purchasing agent and a veteran employe of **Pheoll Manufacturing Company,** has been announced by **Col. John Slezak,** president and chairman of the board.

★ ★ ★

Mr. Schmid joined the company as stockroom supervisor in 1919. He was later transferred to the traffic department, and in 1921 was appointed purchasing agent. He is a member of the Chicago Purchasing Agents Association.

★ ★ ★

Col. Slezak also announced that Fred W. Kuehn, formerly assistant purchasing agent, will succeed Mr. Schmid. Mr. Kuehn joined the Pheoll organization in 1929, holding various positions in the order department, production control, and customer service department. He became assistant to Mr. Schmid in 1933.

Mossberg PRESSED STEEL Corporation

MPS

Greater service from a new **ALL WELDED STEEL TAKE OFF REEL** designed to meet present day requirements.

Usual maintenance expense eliminated by adoption of this new design wherein all parts are welded into one homogeneous unit.

Reel sides are embossed with radial reinforcing ribs for increased rigidity with rolled edges for additional strength and to facilitate handling.

Complete line of spools and reels for both processing and shipping all kinds of bare and insulated wires and cables.

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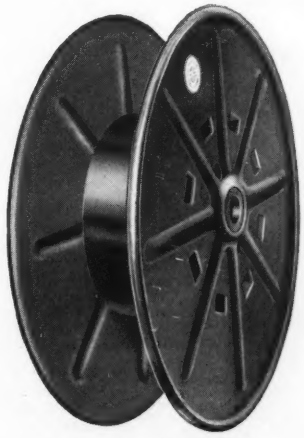

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102

Union Drawn Steel Appoints Metallurgist at Massillon

Robert E. Eirons was appointed recently plant metallurgist for the Massillon plant of the **Union Drawn Steel Division, Republic Steel Corporation.**

★ ★ ★

Eirons has been a member of Union Drawn's Massillon organization for several years. Until his new appointment he was a stainless steel metallurgist.

★ ★ ★

A graduate of Case Institute of Technology, Cleveland, Eirons was a Navy lieutenant during World War II. He and his wife have one daughter. They reside at 251 Indiana Ave., N. E., Massillon.

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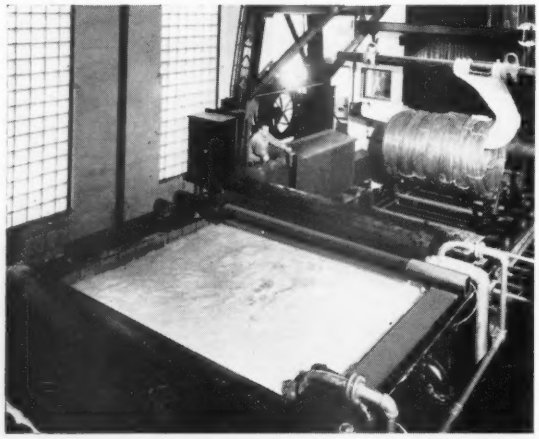
These are the progressive concerns who stand behind their products and have reputations worth sustaining and you can depend upon them.

To INCREASE Your Pickling Tonnage...
...Use HEIL Steam Jet Agitators

A typical wire mill pickler completely outfitted with HEIL E-3 Type Steam Jet Agitators.



The majority of pickling operations throughout this country and Canada have selected Heil Steam Jet Agitators to increase pickling production at lower cost per ton. Violent agitation and proper heating of pickling solution in one simple operation will save valuable time and money.

1. LONGER SERVICE LIFE The combination of special lead alloy and patented nozzle provides rugged construction for longer service life. No breakage from thermal shock.
2. LOWER INITIAL COST Standard Pre-engineered units are available to meet your specific requirements. No down-time necessary for installation.
3. CHOICE OF MATERIALS Standard units are available in either lead alloy for sulphuric acid or impervious graphite for muriatic and mixed acid solutions.
4. YOU SAVE ACID Uniform agitation at higher obtainable temperatures allows you to pickle at lower concentration and thus stretch your acid consumption.

External Shell and Tube Exchangers available for continuous pickling.

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Other Heil Products: Pickling Tanks • Lined Fume Removal Systems Acid-Proof Maintenance Materials • Syphons • Lined Acid-Proof Piping

Joseph S. Cowan

Joseph S. Cowan, manager of government business at the Washington, D. C., Office of **National Electric Products Corporation,** Pittsburgh, died on March 31st in Washington, after a brief illness, at the age of 59.

★ ★ ★

Born in Grant Island, Nebraska, Mr. Cowan received his early education there. During World War I as a member of the Marine Corps he saw active service in Europe. He was a member of the Veterans of Foreign Wars and also of The American Legion. He joined National Electric Products Corporation in 1939. Prior to being named manager of government business in the early part of 1951, Mr. Cowan, for many years, had been in charge of wire and cable sales at the company's Washington Office.

Harry W. Hill

Harry W. Hill, vice president of the **Northwestern Steel and Wire Company,** in charge of operations passed away suddenly of a heart attack on March 23rd while preparing to go to work.

★ ★ ★

Word of his passing came as a shock to his many friends, co-officers and employes of the local plant. He was apparently in good health and had not complained of any illness.

★ ★ ★

There was a genuine feeling of sadness in all departments of the plant from President Paul W. Dillon all the way down to the very last man. All respected and honored "Sandy," as he was affectionately called by his many friends. He was everyone's friend and counseled and carried the burdens of a great many employees. He was never too busy to give advice or assistance where it was sought or needed.

★ ★ ★

Harry W. Hill was born Aug. 30, 1889 in Sterling, a son of Della E. and Robert T. Hill. He was educated in Wallace grade school and Sterling Township high school.

★ ★ ★

A Review of Recent Wire Patents

No. 2,630,145, SPRING UNIT ASSEMBLING MACHINE, patented March 3, 1953, by Robert H. Stevens, Detroit, Mich.

An electrically and magnetically operated machine is provided for assembling helical springs into units by lacing springs.

★ ★ ★

No. 2,630,585, ADJUSTABLE BEDSPRING, patented March 10, 1953, by Clyde B. Reese, Boone, N. C.

This bedspring includes a device for simultaneously adjusting the tension of all of a number of vertical coiled springs related to any desired longitudinal area of the bed spring comprising a longitudinal bar underlying each longitudinal row of coil springs to which the lower ends of the springs are connected, and a second device comprising a number of sets of worm gearing supported upon transverse bars of the bottom frame and having a common operating shaft for vertically adjusting each longitudinal bar.

★ ★ ★

No. 2,630,586, SPRING CUSHION UNIT, patented March 10, 1953, by Murray J. Rymland, Baltimore, Md.

More specifically the invention resides in means to secure together a number of helical coil springs and their tie wires.

★ ★ ★

No. 2,630,611, SAFETY PIN, patented March 10, 1953, by Henry Clay Whittaker, Memphis, Tenn.

The pin is constructed partly of wire but the greater part of the invention resides in a somewhat U-shaped guard.

★ ★ ★

No. 2,631,186, CONDUCTOR INSULATED WITH FUSED MULTIPLE LAYERS, patented March 10, 1953, by Lewis A. Bondon, Arlington, N. J.

★ ★ ★

About the wire conductor is an extruded homogeneous primary insulating coating of a synthetic thermoplastic resin, a spiralled circuit identifying marker of a synthetic thermoplastic resin having identifying means therein surrounding the primary coating and a transparent extruded homogeneous secondary insulation of a synthetic thermoplastic resin over this marker, sealing the marker and the primary coating and forming a single dielectric and single physical wall.

★ ★ ★

No. 2,631,788, WIRE-COILING MACHINE, patented March 17, 1953, by Americo J. Cerasani, Irondequoit, N. Y., assignor to Rochester Lead Works, Inc., Rochester, N. Y., a corporation of New York.

A wire coiling machine is disclosed comprising an electric motor driven winding spindle, wire-cutter, electrical means acting after a predetermined length of wire has been wound to operate the wire-cutter, the electrical means including a switch, a control wheel engaged by the wire, a cam movable into engagement with the switch, drive gearing from the control wheel to the cam, the control wheel including a wire engaging surface, and a device for adjusting the wire-engaging surface radially of the wheel to vary the effective diameter of the surface.

★ ★ ★

No. 2,631,804, WIRE HOLDING CLIP FOR FENCE POSTS, patented March 17, 1953, by Carl F. Uhlhorn, Lewistown, Mont.

The clip comprises rod material formed into a means to retain wire strung along fence posts.

★ ★ ★

No. 2,631,840, COIL SPRING CONSTRUCTION, patented March 17, 1953, by George H. Bugenhagen, Minot, N. Dak.

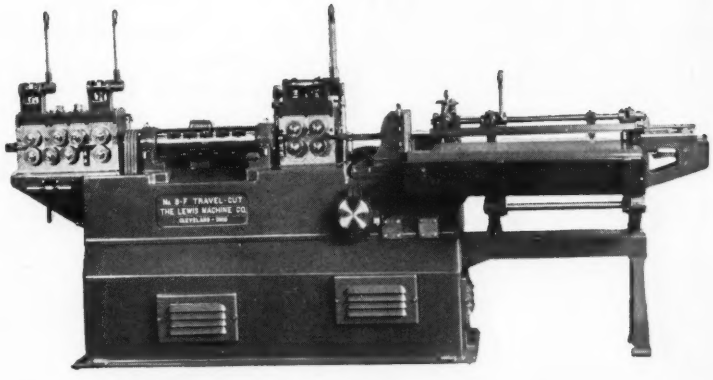
A double coil spring is provided formed from one continuous length of wire, and includes two spiral nested coils with one of them extending in a clockwise direction and the other coil extending in a counterclockwise direction to allow up and down movement of each coil without interference from the other with the inner coil of shorter length than the other, a flat base double loop portion consisting of an outer loop and an inner loop integral with the spiral

★ ★ ★

Fast, Accurate, Economical

STRAIGHTENING and CUTTING

with LEWIS **TRAVEL-CUT**



22 Models to handle from 1/16" to ¾" Round, Hex, Flat, Shapes.

Simple in design, rigid in construction, Lewis TRAVEL CUT will deliver continuous dependable service under the most severe, high production conditions—day in, day out. Feeds wire from the coil, straightens accurately, gauges to uniform length, and cuts clean without stopping the wire. For steel, brass, aluminum and alloy wire. Cut your cutting costs with the Lewis TRAVEL CUT. Full details on request.

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CENTRAL: Moslo Machinery Co., 2443 Prospect Avenue, Cleveland 15, Ohio.

WEST COAST: Hoffman & Heartt, 3005 So. Grand Ave., Los Angeles 7, California.

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Also agents in Paris, Stockholm, Rotterdam, Brussels, Zurich, Milan, Bombay and Melbourne

coils, and a top closed loop for each of the spiral coils with the ends of the wire bent inwardly and downwardly.

★ ★ ★

No. 2,632,356, STAPLE, patented March 24, 1953, by Joseph A. Thiel, St. Louis, Mo.

The staple is formed from wire stock with the legs round but the bight portion flattened. The junctures of the legs and bight portion are straight and circumferentially restricted.

★ ★ ★

No. 2,632,482, APPARATUS FOR BENDING SINUOUS WIRE STRIPS INTO SPRINGS, patented March 24, 1953, by John C. Lincoln, Scottsdale, Ariz., assignor to The Universal Wire Spring Company, Cleveland, Ohio, a corporation of Ohio.

In a machine for forming wire springs from sinuously corrugated wire strips, a plurality of wire twisting devices, each including a frame, a slide on said frame, spring means for shifting said slide in one direction, shifting means for shifting said slide in the opposite direction including releasable coupling means with said slide, and shifting means for rotating said wire twisting shaft in opposite directions, said shifting means for said slide being associated with said shifting means for said wire twisting shaft to effect timed shifting of said slide in predetermined positions of the shifting means for said wire twisting shaft.

★ ★ ★

No. 2,632,602, ELECTRICAL COIL WINDING, patented March 24, 1953, by William B. Weis, Detroit, Mich., assignor to Redmond Company, Inc., Owosso, Mich., a corporation of Michigan.

Wire is carried upwardly through a hollow longitudinally and transversely movable shaft having an independently rotatable upper extension for supporting a field structure and a radially-extending needle element through which the wire passes to the field structure.

★ ★ ★

No. 2,632,603, METHOD AND APPARATUS FOR COIL WINDING, patented March 24, 1953, by William P. Hunsdorf, Cleveland, Ohio, assignor, by mesne assignments, to Cleveland Electrical Equipment Co., Inc, Cleveland, Ohio, a corporation of Ohio.

There are eleven claims in this patent for a fluid pressure-operated wire coil winding machine.

★ ★ ★

No. 2,632,718, METHOD OF DESCALING FERROUS METALS, patented March 24, 1953, by Nathan H. Brodell, Canton, Ohio, assignor by mesne assignments, to William Isler, Cleveland Heights, Ohio.

The method consists in immersing the articles in a solution of completely polyvalent metallic halides or aliphatic and aromatic polyhalides to form a coating of the compound on the article, then heating the article to a temperature such that a chemical change in the coating loosens the scale on the article and then quenching the article in a solution of a compound which breaks the scale away from the article.

★ ★ ★

No. 2,632,955, APPARATUS FOR CHECKING RECESSES IN RECESSED HEAD SCREWS, patented March 31, 1953, by David H. Samuelson, Lyndhurst, Ohio, assignor to The National Screw & Manufacturing Company, Cleveland, Ohio, a corporation of Ohio.

This is a hand-held device including a member insertable in the recess and a movement indicator mounted thereon.

★ ★ ★

No. 2,633,233, DRAWING MACHINE, patented March 31, 1953, by Lee R. Berkebil, Detroit, Mich., assignor to National Steel Corporation, a corporation of Delaware.

A rod drawing apparatus is disclosed having a straight draw line.

★ ★ ★

No. 2,633,246, HAT SUPPORTING HOOK, patented March 31, 1953, by James E. Guthrie, Kansas City, Mo.

The hook is formed of a single length of wire.

Thermoplastic
Cable Sheathing Kraft

the patented paper used in

NONMETALLIC SHEATHED CABLE

Is highly water repellent.
Available in all weights
both creped and flat.

Merrimac
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Also manufacturers of many tailor-made
Varnishing, Saturating, Tubewinding
and Insulating Papers

THE 1953 WIRE & WIRE PRODUCTS

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Now on sale—Order to-day.

Price: $5.00, to subscribers $3.00; no extra charge to members of Wire Association.

WIRE AND WIRE PRODUCTS
453 Main Street Stamford, Conn.

Carboloy's Field Training Course

A field training course in Carboloy cemented carbides was presented to over 500 people March 16 to 20 in Davenport, Iowa.

★ ★ ★

Arranged through the Davenport Engineering Company, a distributor of the Carboloy Department of General Electric Company in Detroit, the course presented was similar to the basic tool course which is held in the Department's home plant each week.

★ ★ ★

Carboloy Department instructors who presented the course included Paul Kunz and Raymond Moessner. The course was conducted by Ernest C. Boyer, Midwest District sales representative.

★ ★ ★

Each "student" received ten hours of training during the week.

Anaconda Engineers Study European Production

Three executives of **Anaconda Wire & Cable Co.'s** engineering staff have returned from a five-week trip through Europe to investigate manufacturing procedures there.

★ ★ ★

A. A. Jones, manager of the Engineering Dept., George Bandre, chief mechanical engineer, and Chester O. Scott, assistant chief mechanical engineer, toured Sweden, Switzerland, Italy, France and England, exploring techniques and equipment currently in use in the wire and cable field abroad.

★ ★ ★

On the basis of their findings, they will make recommendations on the kinds of equipment and apparatus likely to prove valuable in increasing wire and cable production at Anaconda's seven mills.

New Bulletin on Chains and Sprockets

A new bulletin on Baldwin-Rex Roller Chains and Sprockets has just been published by Baldwin-Duckworth, division of Chain Belt Company.

★ ★ ★

The 54 page book describes the inherent advantages of roller chain, and illustrates all the popular sizes of Baldwin-Rex Roller Chains. A section of the bulletin is a treatise on "how to select standard roller chain drives" . . . with formulas, tables and examples illustrating this procedure. Roller Chain dimensions, strengths, weights, and prices are included.

★ ★ ★

This bulletin will be of interest to all who buy, select, and maintain roller chain and allied equipment. For your copy, request Bulletin #52-1 from Baldwin-Duckworth, division of **Chain Belt Company** Dept, P. R. Springfield 2, Massachusetts.

Monsanto Names Chicago Representative

Robert L. Werkheiser has been named Chicago representative for **Monsanto Chemical Company's** industrial resins sales department.

★ ★ ★

MUREX *will be showing at* **THE INTERNATIONAL TRADE FAIR, TORONTO, JUNE 1-12** *on the National Federation of Engineers' Tool Manufacturers' and the Federation of British Hand Tool Manufacturers'*

STAND NO. 3152-4-6-8

See the **Prolite**

CEMENTED TUNGSTEN CARBIDE

WIRE DRAWING DIES

and the 'Prolite' range of Murex Metallurgical products: Tungsten Carbide Tips and Tipped Tools, Bar, Tube and Wire Drawing, Extruding and Metal Forming Dies and Die Pellets, Cold Heading Dies, Nozzles, Guides, Bushes and other Wear Resisting Parts.

TUNGSTEN, MOLYBDENUM, TANTALUM, ZIRCONIUM & SINTERED MAGNETS

Other Murex products being shown will include: Pure Tungsten, Molybdenum, Tantalum and Zirconium, Rod, Wire and Sheet, and fabricated parts; also 'Sincomax' Sintered Composite Magnets and Al-Ni-Co-Fe Sintered Permanent Magnets.

MUREX LTD. *(Powder Metallurgy Division)* **RAINHAM · ESSEX · ENGLAND**

A native of Chicago, Werkheiser has been in the division's research department since 1949. He was graduated from Carthage College in Carthage, Ill., in 1943 with a B.S. degree in chemistry and did graduate work in the same subject at the University of Massachusetts. Before joining Monsanto, he was a research chemist with Interlake Chemical Company of Chicago.

★ ★ ★

He will serve Monsanto's industrial resins customers in Minnesota and Wisconsin, as well as those in Chicago.

Aluminum Shortage Expected to Ease

Contingent on volume of military and stockpile demands, pressure on the civilian aluminum market should be eased in the later months of 1953, it is forecast in the **Aluminum Company of America's** 1952 Annual Report.

★ ★ ★

Both military and civilian markets have stimulated an expansion of the aluminum industry to an all-time record size. Since 1939, when total United States primary aluminum production was just over 163,500 tons, the production capacity of the industry has been enlarged nearly nine times. By the end of 1953, the nation's primary aluminum smelting facilities will be able to produce approximately three billion pounds a year.

★ ★ ★

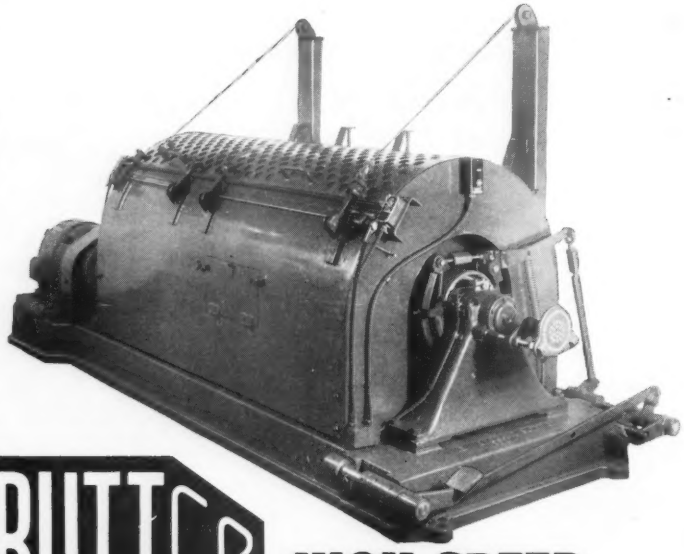
The distribution pattern for aluminum in 1952 was affected materially by Government regulation. Expanding military requirements continued to be given first call in the production of all aluminum products. Not only has aluminum been allocated under the Controlled Materials Plan, but production of aluminum fabricated items has been subject to Government directives.

★ ★ ★

A major factor in limiting the amounts of aluminum available in 1952 was the prevalence of drought conditions in the Pacific Northwest and the Southeast. Water shortages in these areas seriously curtailed generation of hydroelectric power essential to aluminum smelting. It is estimated that 1952 losses in primary production because of these water shortages amounted to more than 50,000 tons for the aluminum industry as a whole.

★ ★ ★

Referring to the future markets for aluminum, the report disclosed that a careful study of existing market trends indicates that this metal will rise to new heights in usefulness in many fields. Among the uses which hold great future promise as large tonnage consumers are: electrical conductors; building and architecture; automotive and air transportation, and chemical processing equipment. And there are many additional fields which will require large quantities of this metal for new developments.



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HIGH SPEED BUNCHER

For fast, economical twisting of small wires, you can't beat the Nebuttco High Speed Buncher. Incorporating many unique features, this machine gives you maximum output per hour at minimum operating cost.

- 1600 twists per minute
- Accommodates reels up to 24" dia. x 12¾" O.A. width with reel arbors 1¼" dia. to 5" dia.
- Large double drum grooved capstans
- Easy change of lay and reverse direction through convenient change gears
- Easy threading and reel change
- Low center of gravity, balanced rotor and heavy cast iron bed assure continued operation without vibration
- Filled reel automatically stops machine
- Supply spool stop motion can be interlocked to stop Buncher automatically

Nebuttco High Speed Bunchers are made in two sizes: S-31 for strands up to No. 14; S-35 for strands up to No. 8. For further details write for Circular No. 63.

NEW ENGLAND BUTT COMPANY
1842
304 PEARL STREET • PROVIDENCE 7, R. I., U. S. A.

JAMES DAY, MACHINERY LTD., 28 MADDOX ST., LONDON, W-1, ENGLAND

New Variable Speed Drive Unit

Reeves Pulley Company has introduced the Flexi-Speed Drive, a new variable speed unit which combines unmatched flexibility in operation and application with low unit cost.

★ ★ ★

Flexi-Speed Drives may be mounted in almost any position around the driven equipment, may drive in any direction, and can deliver any desired speed within a ratio of 8 to 1.

★ ★ ★

This new drive offers the maximum in mounting flexibility. The driven shaft may be located anywhere around the motor shaft, and the speed control hand-wheel may be located parallel to or in any of eight positions perpendicular to the motor shaft. Six different length belts offer a wide choice of shaft center distances.

★ ★ ★

Inexpensive to install and maintain, Flexi-Speed Drives are presently available in ½, ¾ and 1 HP capacities. They are adaptable to essentially all industrial applications, including those with in-line or right angle reducers, countershafts, chain and sprocket of V-belt drives.

★ ★ ★

Reeves Flexi-Speed Drive is ideal for driving to standard gear reducers for parallel drives or worm gear reducers for inexpensive right angle drives. For complete details, write for Bulletin V-532, Reeves Pulley Company, Columbus, Indiana.

To Conduct Quality Control Course

The College of Engineering at the University of Colorado will conduct an intensive training course in Statistical Quality Control from June 16-26. The course will include acceptance sampling and other statistical techniques used in industry.

★ ★ ★

John F. Wagner, Assistant Professor of Applied Mathematics, who will be in charge of the course, says that because we are continually faced with mass-production problems in both civilian and defense goods, the control of quality of the product has become an increasingly important management concern.

★ ★ ★

Instructors for the course will be **E. L. Grant,** of Stanford University, author of **Statistical Quality Control** (McGraw-Hill), **L. A. Knowler,** of Iowa University, and **M. E. Wescott** of Rutgers University, editor of **Industrial Quality Control.** In addition, men from industry will discuss their experiences in applying these principles.

★ ★ ★

The course will be most useful to men who are acquainted with the overall production and inspection operations of a particular company and who are trained in these techniques.

★ ★ ★

Application or further informa-

WIRE SPOOLS, ALL-STEEL, LITHOGRAPHED

Ends and traverses may be shipped separately and assembled easily in your plant on a hand, foot, or power press.
5" and 6½" diameter ends with 1-15/16" diameter traverses.
10½" diameter ends with 3½" diameter traverses.
Traverse lengths up to 12".

J. L. CLARK MANUFACTURING CO.
600 23rd AVENUE • ROCKFORD, ILLINOIS

tion about the course can be obtained by writing John F. Wagner, 214 Ketchum, University of Colorado, Boulder, Colorado.

New Method of Measuring Both Carbon and Sulfur in Steel

Previous to the introduction of high frequency heating, carbon and sulfur contents in iron and steel had to be determined with two separate, conventional tests. With resistance type element furnaces formerly used it took twelve to fifteen minutes per sample to obtain the carbon content, twenty minutes were consumed to test the sulfur content by the evolution method, a (wet) chemical process. The reaction of certain alloys was detrimental to both processes.

★ ★ ★

Now carbon and sulfur contents in all types of ferrous alloys can be determined by means of a newly developed procedure introduced by the **Laboratory Division of Lindberg Engineering Company,** 2450 West Hubbard Street, Chicago 12, Illinois.

★ ★ ★

The new unit, which employs radio frequency inductive heating, tests for both carbon and sulfur in a single operation in ten minutes. The unit is capable of heating samples to temperatures above 3000 F, which is substantially higher than previously practical with resistance element furnaces. Heat is generated only in the relatively small metal sample. Thus tubes, crucibles and other adjacent parts are heated only by conduction or radiation from the comparatively small mass of the sample.

Producing Long Retractor Springs

Among the longest power springs in regular production are spiral wound field telephone retractor springs, made by Sandsteel Spring Division, **Sandvik Steel, Inc.,** 145 Hudson Street, New York City. Each spring measures 47 feet long, ⅜ inch wide, and 0.042 inch thick. In application, two of the "King-Size" power springs are mounted on the cable reel of each portable field telephone unit, and furnish the power needed for automatic rewind of the telephone line after use.

★ ★ ★

By contrast, the smallest power spring regularly produced by Sandsteel is a tongue-end mainspring measuring 5½ inches long, while only 0.024 inch wide, and 0.0024 inch thick. This delicate bit of steel is used for watches and specialized instrument applications.

★ ★ ★

Sandsteel manufactures flat-type power springs in all sizes and strengths according to product specifications.

★ ★ ★

CALENDAR OF COMING EVENTS

***May 7 and 8*—MONTREAL REGIONAL MEETING at the Mount Royal Hotel, Montreal, Can.**

***June 12*—PACIFIC COAST REGIONAL MEETING, San Francisco, Cal.**

***Sept. (date to be announced)*—NON-FERROUS DIVISION MEETING, Waterbury, Conn.**

***Nov. 9 - 12*—THE ANNUAL CONVENTION OF THE WIRE ASSOCIATION, with headquarters at the LaSalle Hotel, Chicago, Ill.**

All of these meetings will be publicized in Wire and Wire Products and complete programs published well in advance of the meetings. Members of The Wire Association will also be circularized by mail and hotel reservation cards, where needed, will be enclosed.

THE WIRE ASSOCIATION
RICHARD E. BROWN, Executive Secretary

453 MAIN STREET STAMFORD, CONN.

Properties of Fluorothene Insulated Wire

(*Continued from page* 465)

By minimizing the crystalline growth and thus large spherulite growth, some properties of the resin are enhanced. When large spherulites are present, the interface between such spherulites become points of possible weakness during bending where cracks or dielectric strength failure can occur. Most of the crystallite growth occurs within twenty-four hours after aging at 150 deg. C. Spherulite development, if it continues beyond this time, is so slow as to be practically undetectible. Aging for one week at 150 deg. C. is considered to be, at the present, equally as severe as a much longer period at this temperature.

★ ★ ★

Figure IV (See page 465) illustrates the improvement in dielectric strength resulting from orienting the insulation during extrusion. Optimum results are obtained when the polymer is oriented during extrusion so that at least 50 per cent shrinkage is present in the finished wire.

★ ★ ★

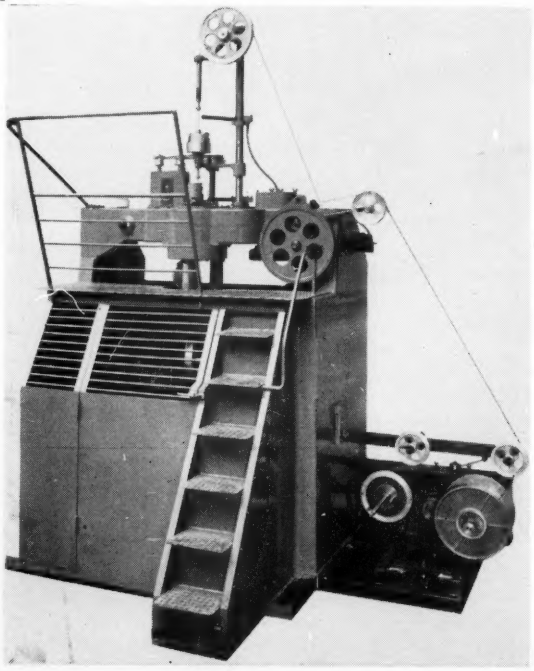
The advantage of minimizing spherulite growth by means of orienting the insulation has been further confirmed by oven aging tests conducted on highly strained and low strained samples. Table III gives tensile strength and elongation before and after aging for two samples—one showing 65 per cent shrinkage, and the other showing 11 per cent shrinkage. As is to be expected, the oriented sample gave higher initial tensile strength than the unoriented sample. The highly strained insulation after aging for one week at 150 deg. C. showed a slight drop in tensile strength, but its original elongation showed some slight improvement. The insulation which shows only very slight orientation had a lower initial tensile strength which increased somewhat on oven aging. Its initial elongation was completely lost after aging due to the rapid increase in crystallinity and spherulite growth. It is extremely significant that these results confirm what had previously been experienced in the case of dielectric strength and also followed the predicted behavior based on theory.

TABLE III

	Original	*After one week at 150°C.*
Highly strained Insulation, 65% shrinkage		
Tensile Strength—psi	**8760**	**7510**
Elongation—%	**90**	**120**
Low strained Insulation, 11% shrinkage		
Tensile Strength—psi	**5480**	**5770**
Elongation—%	**135**	**Too low to measure**

A New Machine . . .

THE POURTIER QUADDING MACHINE



- 2 lays per rotation of the flyer
- Special balancing capacity device
- Automatic stop motion in case of breakage of paper or cotton, on a predeterminated length
- Compensator device controlling the unrolling of the feed-drums and the equality of tension of the four ends
- Double take-up: compensator motion controlling the tension of the quad. Transversal movement of the reels instead of traverse
- Lays easy to reverse and to adjust
- Lockheed braked
- Automatic central lubrication
- Able to be used as a twinner
- Production: 500 lays per minute
- Feed-drums: maximum 16"
- Take-up reels: Maximum 18"
- Lays: from 1 to 7 lays per foot

POURTIER MACHINES

153, rue Gallieni, ROMAINVILLE (Seine) FRANCE

The results of this work allow the preparation of insulated wire samples which retain in very large measure their original excellent dielectric properties after severe aging at elevated temperatures and enables the wire to easily meet such existing specifications as the Signal Corps hook-up wire specification. What was originally a very trying and disturbing problem concerning the loss of dielectric strength after aging, is now a well-understood phenomena which can be controlled.

★ ★ ★

We presently feel that the polymer is useful as a wire insulating material for continuous service at temperatures up to 150 deg. C. As more is learned about the material, and as additional experience is gained by those wire manufacturers using this polymer, it is expected that the operating temperatures may move higher.

★ ★ ★

Material Evaluation

(*Continued from page* 478)

suming all our graphs are normal and the wire is not up to standard, it might point to a highly contaminated or piped rod, which in turn would cause breakages or surface checks. If the rod received has a higher tensile than we want, we know that the grain structure is finer than can be used and therefore should be used for a heavier finished gauge to prevent drawing into the high fibrosity range, which would give us a very poor torsion quality. In other words, with this slide control it is possible to evaluate the rod before drawing and determine the probable qualities that will result from drawing within a range of gauges.

★ ★ ★

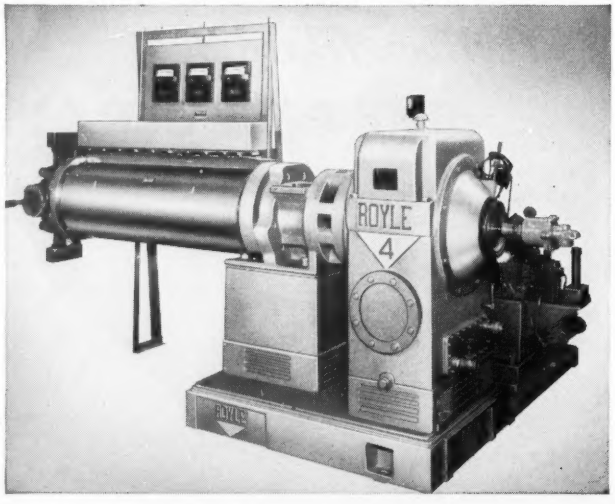
The slide control illustrated indicates we have a chemical analysis of C- .55, Mn- .90, P- .010 and rod tensile of 145,000 p.s.i., which indicates what the tensiles will be at the various gauges; for example: at .075″ it will be 260,000 p.s.i. and at .080″ it will be 252,000 p.s.i., and so on.

New Catalog on Stainless Steel Electrodes

Alloy Rods Company, York, Pennsylvania, largest manufacturer of stainless steel alloy arc welding electrodes, has just released a 20-page catalog in color on its complete line of Arcaloy Stainless Steel Electrodes. The catalog includes explanation of the two basic types offered—Lime coating for all-position welding with DC reverse polarity, and AC-DC for welding of chrome-nickel steels with all types of AC or DC welding equipment—individual descriptions of the 23 regular analyses and special analyses of Arcaloy electrodes, weld metal properties, welding procedures, electrode analysis and color charts, current ranges, and A.I.S.I. type numbers. Copies of the new catalog may be secured by writing Alloy Rods Company, York, Pennsylvania, and asking for Bulletin AR53-16.

ROYLE
SPIROD* EXTRUDERS

Built by America's oldest builders of extruding machines Royle Spirod extruders are the result of more than seventy years experience in the design of extruding machines. Time tested and proven features are built into Royle Spirod extruders to assure maximum productivity at minimum operating cost. These features include: Heavy steel members without flanges . . . Spirally installed rod type heating elements to provide faster, steadier, more evenly distributed heat . . . Complete insulation of cylinder and head to reduce heat loss with substantial power savings . . . Separate heating zones controlled by proportioning instruments.



CHECK THESE FEATURES that assure profitable and trouble-free production of such items as plastic insulated wire, flexible and rigid pipe, plastic sheeting, plastic clothes line, to mention a few of the products that are produced daily with Royle Spirod extruders.

*Patent Applied for

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. — REgent 2430
Home Office — V. M. Hovey J. W. VanRiper — SHerwood 2-8262
Akron, Ohio — J. C. Clinefelter — JEfferson 3264
Los Angeles, Cal. — H. M. Royal, Inc. — LOgan 3261

PATERSON 3, NEW JERSEY

The Diamond Tool Industry in 1952

As before, the **Industrial Diamond Information Bureau** has compiled a survey of the diamond tool industry in the previous year, dealing with scientific aspects, hardness testing, wear and abrasion testing, shaped diamond tools, diamond truing tools, rock drilling, etc. This report, slightly smaller than last year, gives 139 references to other sources of information. It is mentioned that copies of this survey and all the literature mentioned in it, are available from the Industrial Diamond Information Bureau, 32-34 Holborn Viaduct, London, E.C.1.

Carbide Flattening Rolls Cut Costs

When squeezed between rising costs and narrowed markets there is one natural thing to do. Examine the production setup to make it more efficient. That's what the **Knowles Loom Reed Works Inc.,** New Bedford, Mass., did.

★ ★ ★

The company, which rolls stainless steel wire for loom reeds that the textile industry employs in the process of weaving cloth, made a plant survey recently in an effort to control costs and improve the quality of its product.

★ ★ ★

It discovered that:

1. The metal rolls used in rolling wire for reeds allowed only a maximum of two weeks' production per spot per roll.

2. As they wore or mushed, the rolls also tended to crown the reed wire slightly and caused rejects.

3. Continuous checking of wire sizes was a must at the start, and during the production run, because the steel rolls expanded and contracted under the heat of the run to produce product variations.

★ ★ ★

According to **Joseph Dawson, Jr.,** president, and a specialist in making reeds with 35 to 90 dents per inch, superior work finish, absolutely flat wire and uniformly close tolerances are necessary to facilitate producing loom reeds that provide quality woven products. The operation involves rolling the stainless wire into reeds ranging from 0.005 to 0.025-inch thickness by means of a pair of rolls running at a speed of about 70 rpm.

★ ★ ★

To keep the reed wire at a uniform size and to close tolerances, the spot or path traveled by the material going through the rolls is changed periodically. This is done by means of adjustable guides. Since the spot of the wire travel becomes worn in about two weeks, it doesn't take long on a 9-hour, 5-day week schedule, before the whole face areas of the two rolls are worn to a point where replacements are needed.

★ ★ ★

This was changed when tungsten carbide rolls manufactured by the **Carboloy Department of General Electric Company,** Detroit, were installed. Great savings came almost immediately. Reed size variations were no longer a problem while the wire was being processed

WAFIOS

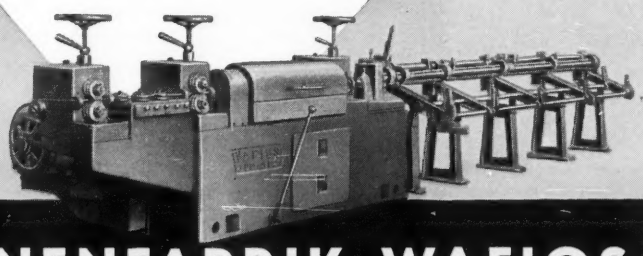
WIRE-WORKING MACHINERY

Wire Netting Machines for Chain Link, Hexagonal Mesh, Poultry Netting, Field Fence. Crimping, Barb Wire and Staple Machines. Spring Coilers. Spring End Grinding Automatics. Loop Benders. Upholstery Spring and Wire Mattress Machines. Wire Nail Machinery. Chain Formers. Chain Welders. Straightening and Cutting Machines. Multi-Slide Wire and Strip Forming Machines. Special Machinery for the making of Paper Clips, Lock Washers, Bale Ties, Key Rings, Tin Openers, Wire Bag Ties, etc. Automatics for Flexible Metallic Tubing.

Sole Agents for Australia and New Zealand: Bliss & Reels Co. Pty. Ltd., 64-66 Little Bourke Street, Melbourne C. 1, Australia.

WAFIOS

SINCE 1893



MASCHINENFABRIK WAFIOS

WAGNER, FICKER & SCHMID REUTLINGEN 3 / WÜRTT. GERMANY

through the rolls. This first saving produced a second—in manpower. Instead of tying up one man for each machine, a single operator could handle several.

★ ★ ★

After a 22-month recapitulation of the roll equipment's production efficiency, the company found that roll wear was reduced to practically nil. Instead of changing the rolling spot 24 times a year, as it was necessary previously, the company discovered it was rolling stainless steel wire on the same spot on the Carboloy carbide rolls a year later, with no sign of wear.

Norton Opens New Plant

Norton Company of Worcester, Mass. began operations in its new $6,000,000 expansion of its Grinding Machine Division March 31st, in a week-long Open House. This plant provides increased capacity for the production of Norton's complete line of 45 different types of precision grinding and lapping machines.

★ ★ ★

The plant, built to meet the demands of the present defense effort, consists of a 740-foot by 300-foot factory adjoining a 360-foot by 100-foot office building. Among its many features are straightline production methods, new modern machine tools, special materials handling equipment, air-recirculating dust control equipment, forced ventilation providing three complete air changes per hour, and many others.

★ ★ ★

The factory itself is of single story, modern construction, providing 275,000 square feet of working space, enlarging the company's machine tool manufacturing capacity by about 50%.

★ ★ ★

Bulletin on Pumping Unit

A new small, low-cost Farval DC-20 automatic pumping unit is described in Bulletin No. 39, issued by The Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio. It is engineered to provide the same trouble-free dependable lubrication for single machines that large Farval centralized lubricating systems have given on heavy-duty industrial equipment for over a quarter century.

★ ★ ★

The bulletin tells what it is, what it does and how it works. The unit is intended for use with Farval Dualine valves for automatic centralized lubrication, with these advantages:

1. **Accurately metered amounts of lubricant—without waste or spillage.**
2. **Positive frequency control—lubricant as often and as much as needed.**
3. **Completely automatic independent time clock control.**
4. **Increased safety—machines lubricated while running without hazard to operator.**
5. **Extended bearing life.**
6. **Less downtime—increased production.**

★ ★ ★

You are invited to send for a copy of Bulletin No. 39.

★ ★ ★

Wire Product Firm Building New Plant

John Hassall, Inc., Brooklyn, N. Y., manufacturers of rivets, nails and other cold headed products, is presently building a new plant at Westbury, L. I., to provide themselves with larger and more

EW

HIGH PRODUCTION METAL LOOMS

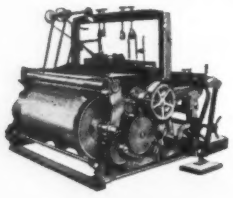
S.A.M.P.

Type BM for mosquito & fly nets, paste factories, armour plate glass, corn sieves, etc.

Type XL for flour mills, chemical and industrial works, etc.

Type CP for "Rabitz" cloth, plastering work, armour plate glass, etc.

Type CM for extra strong metal cloth for sieves, grain, rice, armour plate glass.



Jarach-Guetta, Industrial Overseas Co., Inc.

120 Wall Street, New York 5, N. Y.

General Agents of EMILIO WARTENWEILER,
Via Pergolesi 18, MILAN (Italy)

modern facilities. The new plant will enable the company to operate more efficiently and provide space for future expansion.

Hardness Conversion Tables for Steels

A celluloid card, wallet size, giving approximate relationship between Brinell, DPH (Vickers), Rockwell and Shore Scleroscope hardness values and corresponding tensile strengths of steels has been put out by **The International Nickel Co.,** based on data from the SAE Handbook.

★ ★ ★

For one of these cards, write to the company at 67 Wall St., New York 5, N. Y.

Norton Moves New York Sales Office

The New York City domestic sales office of the Abrasive Division, Grinding Machine Division, and Refractories Division of **Norton Company,** Worcester, Mass., formerly 61 Broadway, has been moved to Green and North Street, Teterboro, New Jersey, effective March 23rd.

★ ★ ★

The new headquarters at the Behr-Manning warehouse and office at Teterboro (a Norton Company affiliate), has been established to improve service to customers in the New York industrial area. The new location, with expanded telephone coverage, will be more accessible and convenient for users of grinding wheels, grinding machines and refractories.

★ ★ ★

The office of Norton Behr-Manning Overseas Inc., will remain at 61 Broadway, New York 6, New York.

Monsanto to Produce Polyethylene Plastics

Monsanto Chemical Company has announced that it will enter the field of manufacturing polyethylene plastics, making Monsanto the first company to produce the "Big Six" in plastics for molding and fabricating.

★ ★ ★

Robert K. Mueller, general manager of Monsanto's Plastics Division in Springfield, Mass., said that initial annual capacity of the new polyethylene plant will be about 66 million pounds and will be in production early in 1955 with a 50 per cent increase in capacity projected for 1957. This is expected to represent nearly 20 per cent of the total polyethylene capacity in 1957 or 22 per cent of the forecasted market for that year. The site for the new manufacturing unit has not been announced and depends on studies underway for some time on raw material sources and the future markets for the plastic, he said.

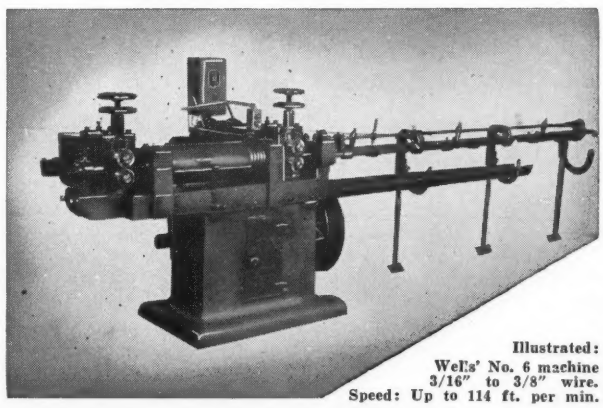
★ ★ ★

The Monsanto line will then be comprised of styrene, phenolics, cellulosics, vinyls, aminoplasts and polyethylene.

★ ★ ★

STRAIGHTEN and CUT SMALL WIRES

ON FAST, DEPENDABLE WELLS' AUTOMATIC ROTARY MACHINES



Illustrated: Wells' No. 6 machine 3/16" to 3/8" wire. Speed: Up to 114 ft. per min.

THIS MACHINE WILL CUT wire accurately and fast in any length from 7½" up to 25', but must be ordered for the maximum lengths to be cut.

The straightener flier runs in ball bearings. Has 2 H. P. motor arranged for direct drive. Drive gears are located inside of the base. Illustration shows the flier and drive open to show mechanism.

Furnished with 2 sets of hardened tool steel dies.

WELLS' machines are backed by 58 years of experience and of constant effort to improve their efficiency.

The result for you is a line of straightening and cutting machines that will handle the toughest jobs, day in, day out, year in, year out, with little or no servicing. Customers report uniformly high satisfaction with the operation of their WELLS equipment.

Built in a complete range of sizes for all wire gauges.

send for Catalog No. 50 covering the full line.

Frank L. Wells Company

KENOSHA • 5821 Fifth Avenue • WISCONSIN

Builders of Fine Wire Working Machinery

Booklet is Source for Welding Aids

Key production and maintenance men, metallurgists, and others interested in welding methods will find a wealth of technical information on the welding of stainless, low-alloy high-tensile, and non-ferrous metals in a booklet just published by **Arcos Corporation,** Philadelphia, Pa.

★ ★ ★

This 18-page booklet is an index and guide to a series of bulletins, charts, and articles prepared as "working tools" to facilitate welding and aid those responsible for plant welding practices to attain consistent quality results.

★ ★ ★

The following technical information is listed as available:

1. **Application chart, giving descriptive information about 56 different electrodes.**
2. **Data sheets, giving complete information on specific electrodes.**
3. **Electrode selector folder, containing basic clues to the selection of the right electrode for welding.**
4. **Chart of electrodes recommended for salvage and fabrication welding of alloy castings.**
5. **Booklet on "The ABC's of Welding High Tensile Steels."**
6. **Selector chart for welding high strength low alloy steels.**
7. **Selector chart for meeting Army, Navy, and AMS specifications.**
8. **Technical guides on specific metallurgical information.**
9. **Chart on stainless cut and coiled wire to help in the selection of the proper stainless wire for semi-automatic and automatic welding.**

★ ★ ★

The booklet or any technical information listed therein may be obtained by writing Arcos Corporation, 1500 So. 50th St., Philadelphia 43, Pa.

Standardize on ACROPAK* Spools!

Only ½ the Weight!

YET STRONG, TOUGH, RIGID . . LONGER LIFE

ACROPAK Spools will help you cut wire packaging costs because they give longer service, require less maintenance and cost less to ship. They're strong. They'll take repeated shippings and still run true on the arbor. They're machined to close tolerances. You can run them at high production speeds with fewer snags, less toe-out and minimum end breakage.

Light Weight
Precision built
Reduced cost
Longer life
Extra strength
Dynamic balance
Greater production
Low cost reconditioning
Less maintenance
Attractive packaging

THEY CUT YOUR SPOOLING COSTS

Best proof of ACROPAK superior performance are the millions of these spools now used by the biggest names in the wire industry. We've proved it to them—let us prove it to YOU.

★ We also make a complete line of heavy-duty shop processing STEEL SPOOLS built to the same high standards of accuracy and rigidity as the famous Acropak aluminum spools.

ACROMETAL PRODUCTS INC.
Division U S Bobbin and Shuttle Co., 616 Fifth Street N., Minneapolis 1, Minn.

G. E. Produces New Silicone Putty

Silicone "bouncing putty," one of the most intriguing chemical curiosities, has now gone to work for industry. The General Electric Company, whose chemical division is a major silicone producer, has found it helps to improve welds in steel plates and pipe.

★ ★ ★

The famous G-E silicone material which can be pulled like taffy, broken with a quick snap, or bounced like a ball, is being thinned to a fluid paste and marketed as a weld-backing compound by the company's welding department at Fitchburg, Mass. Painted on joints before welding, the product is said to promote uniform weld penetration and to eliminate the harmful effects of air on the underside of welds. It is suggested for use in all arc welding processes except automatic inert-arc welding where argon is used as the shielding gas.

★ ★ ★

General Electric says the new compound overcomes many of the disadvantages of fluxes, metal and gas backing media. It is easily applied to complex parts and the powder residue left after welding can be quickly removed with a cloth. Because it promotes no carbon pickup in the weld, it is

very useful in the welding of low-carbon stainless steels. The compound gives off no noxious fumes, and is non-explosive.

★ ★ ★

One 16-ounce can of the paste covers 1300 lineal feet of joint when applied in a strip one-half inch wide. The product is available from the **General Electric Company,** Fitchburg, Mass.

Replacing Mineral Acids in Scale Removal

The Magnus Chemical Company, of Garwood, N. J., has released reports on the use of their D-Scale-R line of inhibited acid cleaners in a number of plants to replace muriatic acid in the removal of heat treating and annealing scale, rust and carbonized drawing soaps from various steel parts. The D-Scale-R line is based on the use of a solid material which does not become active from an acid standpoint until dissolved. Not only is it easier and safer to

Welcome to Montreal

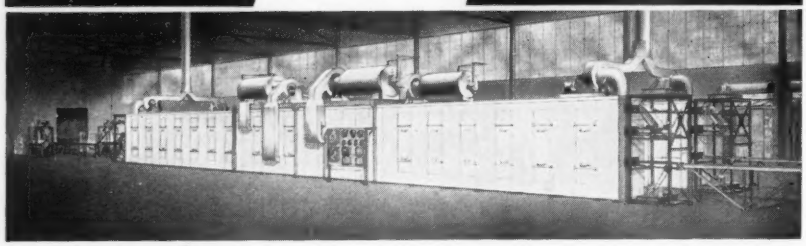
THE HOME OF CANADA'S LARGEST CABLE REEL MANUFACTURER

J. HAMELIN
LUMBER & WOODWORK, LTD.
LACHINE, QUE., CANADA
Tel. Nelson 5-4074
Established in 1938

We build again: Hexagon Wire Netting Machines
Mesh widths 1/4" - 4"
Working widths 3' - 12'
for wire BWG 22 - 13 1/2
Model TUDN
SINCE MALMEDIE 1873
MASCHINENFABRIK GMBH DÜSSELDORF / GERMANY

CARL-MAYER WELDING ROD OVENS

PATENT NOS. 1,843,430 2,373,325



One of Several Carl-Mayer Ovens at Hollup Corp.

FAST, EFFICIENT AND ECONOMICAL DRYING OF COATED WELDING RODS.

Only in Carl-Mayer Ovens can you obtain the combination of the recirculating gas fired air heater principle and the "Mayer" patented rod transfer system — two highly important features in ovens of this type.

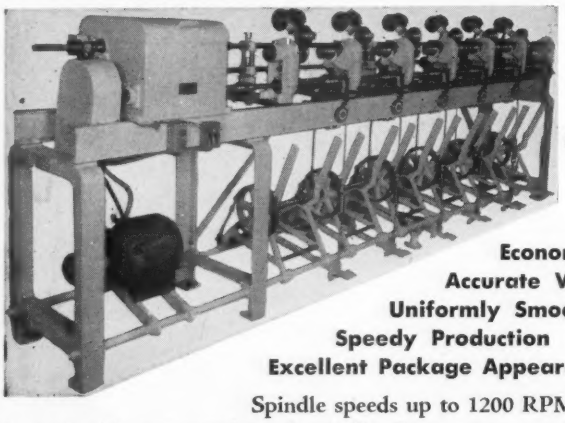
We also build other types of industrial ovens and furnaces. Carl-Mayer installations are backed by reputation for unusual performance, and over 30 years' experience.

WRITE FOR BULLETIN NO. 350

THE CARL-MAYER CORPORATION

3030 EUCLID AVENUE
CLEVELAND, OHIO

DEPENDABLE • ACCURATE WINDING



BOYD MULTI-HEAD SPOOLER

Improved Design
Precision
Engineered

Economy Operation
Accurate Winding
Uniformly Smooth
Speedy Production
Excellent Package Appearance

Spindle speeds up to 1200 RPM are possible. Can be had with any number of spindles from one to twelve. The six-head spooler shown above has a common traverse for all spindles. Each spindle is started independently by manual control — and stops automatically at predetermined footage. Traverse changes from ½ to 8" or more are easily made. Winds wire on spools up to 10" or 14" in dia. Anti-friction bearings throughout. Counter stop-motion, wire compensators and wire straighteners optional. Operator requires no training, skill or experience.

Send for full details.

BOYD & SONS MANUFACTURING CORPORATION

1434-38 Callowhill St. **Philadelphia 30, Pa.**

ship, handle and store, but since it is inhibited against action on metals, it is safer in use than mineral acids.

★ ★ ★

In an eastern plating shop, a large volume of stampings and rod stock has to be pickled to remove heat-treating scale prior to zinc or cadmium plating. Formerly these parts were cleaned in an alkaline cleaner, rinsed and pickled in 10% muriatic acid solution, then rinsed and tumbled in a cyanide solution. Results were satisfactory, although the shop was not very keen about the use of the strong acid. However, they felt that it was possible to cut down the material handling and time involved.

★ ★ ★

The Magnus method ultimately adopted did just that. The entire cleaning operation is done with Magnus D-Scale-R. Parts that can be self-tumbled are loaded into the barrel until it is 2/3 full. Water and D-Scale-R at the rate of 8 ounces per gallon are added. On stampings, chips are added. Where scale is heavy, the concentration of D-Scale-R is increased.

★ ★ ★

On the average, parts are tumbled for less than 30 minutes. They are then free of scale, and after draining are run for a few seconds in water to which an alkaline cleaner has been added to neutralize any remaining traces of the acid cleaner. They report that their savings in labor alone with the Magnus method amount to more than 10 times the total cost of the Magnus method.

★ ★ ★

The concentration of the solution is ½ lb. of the D-Scale-RS per gallon of water. Parts are tumbled for 30 minutes, then rinsed. They come out completely clean, with no need for hand-brushing. Production has been materially increased. Acid handling hazards are, of course, ended.

New Die Header Manual

A new header die manual that tells how to drill, assemble and finish series HN rough-cored head-

er die nibs employing the new grade 190 tungsten carbide is announced by **Carboloy Department of General Electric Company,** Detroit 32, Mich.

★ ★ ★

Besides outlining advantages and applications of grade 190 tungsten carbide, the nine-page publication, D-131, includes information on nib standards, heading die design, shop equipment and other data for preparing nibs and header die casings.

★ ★ ★

Standardization of the HN series header die nibs has reached the point where they can accommodate over 90 per cent of production requirements, according to Corboloy Department. The many size combinations available from standard 190 carbide nibs, plus the fact they are readily machinable with harder carbides, make them profitable to use. Copies available upon request. Please ask for Manual D-131.

★ ★ ★

W. H. A. Robertson Medal Award

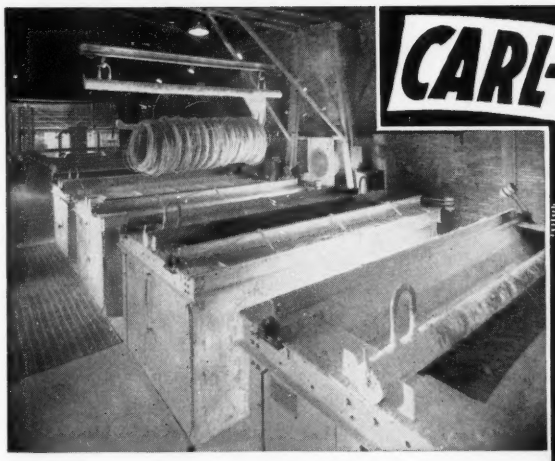
The Council of the Institute of Metals has awarded the 1952 W. H. A. Robertson Medal and a Premium of Fifty Guineas to **John Francis Waight,** Engineer, West Midlands Gas Board, for his paper on "Gas Equipment for the Thermal Treatment of Non-Ferrous Metals and Alloys," published in the "Journal of the Institute of Metals," 1952, vol. 80, pp. 269-285.

★ ★ ★

The Medal and Premium of Fifty Guineas, placed at the Council's disposal by W. H. A. Robertson and Co., Ltd., is awarded annually for the encouragement of the writing and publication in the Institute's "Journal" of papers on engineering aspects of non-ferrous metallurgy. MSS. of such papers should be addressed, in the normal way, to The Secretary, The Institute of Metals, 4 Grosvenor Gardens, London, S.W.1.

Lindberg Opens West Coast Plant

Lindberg Engineering Company, Chicago, Illinois, opened its new West Coast Plant at 11937 South Regentview Ave., Downey, California, on March 25th.



CARL-MAYER

HI-SPEED REGISTERED

ROD BAKERS

PATENT Nos. U.S.A. 2,235,559 2,296,361 2,323,828 CANADA 396,144 401,589

ALSO OTHER TYPES OF INDUSTRIAL OVENS AND FURNACES

GREATER SPEED AND FUEL ECONOMY PROVES OUTSTANDING ENGINEERING

Carl-Mayer Hi-Speed Rod Bakers have an exclusive heating arrangement, combining faster baking with amazing fuel economy—and a patented Blow-Off feature which removes moisture without bumping or agitating the coils. *WRITE FOR BULLETIN NO. 350.*

SERVING CONCERNS LIKE THESE:

American Steel & Wire Co.
Atlantic Wire Co.
Atlas Steel Co.
Atlas Tack Corp.
Babcock & Wilcox
Canadian Steel Corporation.
California Wire Cloth Corp.
Colorado Fuel & Iron Corp.
Crucible Steel Co. of America
Eaton Manufacturing Co.
Frost Steel & Wire Co., Ltd.
B. Greening Wire Co., Ltd.
Gary Screw & Bolt Division of Pittsburgh Screw & Bolt Corp.
Hollup Corp.
Indiana Steel & Wire Co.
Johnson & Nephew, Ltd.
Jones & Laughlin Steel Corp.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Republic Steel Corp.
Steel Co. of Canada

THE CARL-MAYER CORPORATION

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CLEVELAND, OHIO

VINYLS for...

CRITICAL CUSTOMERS

For the past ten years we have specialized in the compounding of Vinyl extrusion and injection molding compounds to specifications, or developing compounds for a specific use.

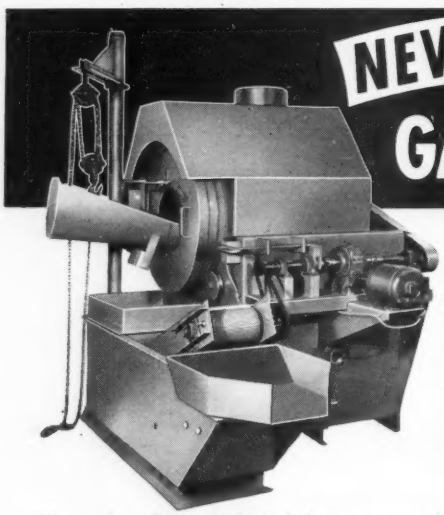
Underwriters' approved standard compounds are available in all colors for POT, T, TW, 80 Degree C, 90 Degree C and 105 Degree C wires.

Save your plant space for wire processing equipment. Let us tailor your compounds to bring out the special properties you require.

Your inquiries are invited.

ELECTRONIC RUBBER COMPANY

69 Sunnyside Ave. • Stamford, Conn.



NEW NAIL GALVANIZER

Built for medium production, this machine has all features of larger units. Production varies from 600 to 1000 pounds per hour, depending upon requirements. The unit occupies a minimum of floor space — approximately 10' x 10'.

The main cylinder is heated from a brick lined combustion chamber which may be either gas or oil fired.

By reversing the rotation of the cylinder the nails are discharged through baffles a few at a time into water. A mesh belt then delivers them to a gathering pan that is heated to assist in drying the nails.

Drying and kegging operations take place while another batch of nails is being galvanized in the cylinder.

Write for complete information. This machine is also ideal for bluing of nails and small parts.

MORRISON INDUSTRIES

MORRISON INDUSTRIES, INCORPORATED
17100 MILES AVENUE • CLEVELAND 28, OHIO

NORBIDE® Abrasive

The Hardest Manufactured Abrasive for Cutting and Polishing Dies

One hundred fifty times less expensive than the diamond.

Norbide Abrasive—Norton Boron Carbide effectively rips and semi-finishes wire drawing dies—especially efficient on cemented carbides.

Catalog 559-W

NORTON COMPANY
WORCESTER 6
MASSACHUSETTS

NORTON® *Making better products to make other products better*

This new factory comprises 12,000 sq. ft. of production and office space and will be used to manufacture industrial heat treating furnaces and other Lindberg products used in aircraft and other vital West Coast industries.

★ ★ ★

The new facilities were built to provide better servicing operations and to speed deliveries. It will also offer FOB Los Angeles prices on the complete line of Lindberg products.

To Head Sprague Electric Office at Dayton, O.

Allan J. Weinberger has joined the **Sprague Electric Co.,** of North Adams, Mass., as Manager of its Dayton, Ohio, application engineering office, it was announced by **Neal W. Welch,** Director of Sales of the Sprague Company.

★ ★ ★

Mr. Weinberger was formerly Section Head of the Test Devices Division of the U. S. Naval Ordnance Plant at Indianapolis.

★ ★ ★

Widely known in the electronics industry, he was formerly associated with the Radio Corporation of America, both at Camden, New Jersey, and at Indianapolis, with Electronics Laboratory, Inc. of Indiana, and The Stewart-Warner Corporation.

★ ★ ★

He succeeds **William M. Lana,** who has been transferred to the Sprague office at Culver City, California, as Assistant Sales Manager.

Wire Firms Merged

Consolidation of two of Attleboro's oldest companies became effected April 1, it was announced by **Charles W. Engelhard,** president of both companies and also of the Engelhard Industries, of Newark, N. J., of which the corporations have been members for several years.

★ ★ ★

Under this consolidation the **D. E. Makepeace Company,** established in 1897, will continue as the operating division of Union Plate

& Wire Company which was established in 1906. The former company is one of the nation's largest producers of precious metals laminated to base metals for electrical and electronic applications, and it also manufactures gold-filled materials for the jewelry and optical industries. Union Plate and Wire Company makes similar types of laminated sheet, wire and tubing for various industries. General offices will be in the Makepeace plant at Pine and Dunham Streets, Attleboro, Mass.

★ ★ ★

In addition to Mr. Engelhard, president, officers of the consolidated company will include **Harry Klausmann,** executive vice-president; **W. F. Mittendorf,** vice-president and general manager; **Washington Irving** and **L. W. Van Dernoot,** assistant treasurers, and **A.W. Cunningham,** superintendent.

New Rockford Firm Produces Precision Springs

Rockford Spring Company, an Illinois corporation organized in October 1952, is now in full production. **John E. Wing Jr.,** is President. The company was chartered with an authorized capital stock of $250,000.

★ ★ ★

The new firm is now producing a wide variety of mechanical springs for industrial uses in large range of wire sizes from .005 to .5 inches. A complete line of compression, extension, and torsion springs are manufactured with special emphasis on quality control. Because of the highly specialized character of the industry, the company is concentrating its efforts in the precision spring field where accuracy and quality are especially important. To handle special or unusual spring problems, engineering and consultation service is offered without cost or obligation.

★ ★ ★

Mr. Wing is a former executive of the **Illinois Coil Spring Company.** He was connected with the Chicago firm for 5 years, serving as both Plant Manager and Sales Manager. Associated with Mr. Wing in the new enterprise are

High Quality

COPPER and BRONZE WIRE

High Carbon and Low Carbon

Specialty Steel Wire

Spencer wire corporation

★ 555 LEHIGH AVENUE, UNION, N. J.

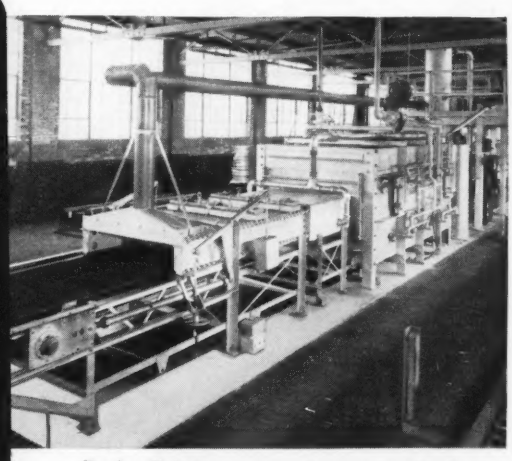
Plants at Union, N.J., Hillside, N.J., West Brookfield, Mass.

ROCKWELL FURNACES

for Annealing Hardening · Drawing · Normalizing Galvanizing and Tinning

Batch or Continuous · Oil, Gas or Electric

Direct Heated Muffle Type Radiant Tube Atmospheres



Rockwell belt conveyor furnace, gas-fired, for bright annealing wire on spools or in coils in a controlled, protective atmosphere in heating and cooling zones. Other Rockwell furnaces for wire mills include parallel muffle tube, pit, hood, pan and other types. Write for Bulletin 432.

ROCKWELL ALSO BUILDS

Coil winding, machines, reels and spools; pickling, brushing, cleaning, washing, finishing, drying and handling equipment; ovens and dryers; non-ferrous rod mills.

W. S. ROCKWELL COMPANY

FURNACES • OVENS • BURNERS • VALVES • SPECIAL MACHINERY

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S. A. ETECO

ZWEVEGEM
(BELGIUM)

Selling Office for
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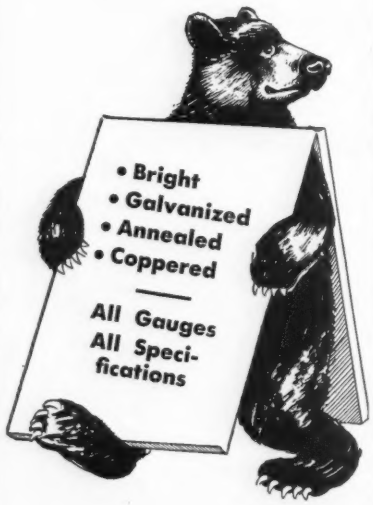
STEEL WIRES

IF YOU REQUIRE



Submit your

SPECIFICATIONS

To The

REPRESENTATIVES:

J. GERBER & CO., INC.

855 Avenue of Americas
NEW YORK 1, N. Y.

Reuben L. Emerson, Secretary, **E. F. James**, Asst. Secretary-Treasurer, and **Roy H. Fuerstenau**, Production Manager.

★ ★ ★

The plant, located at 1032 Mulberry Street, occupies 8500 square feet of space, and is furnished with the latest machines. New, modern equipment includes automatic coilers, torsion coiling machines, hooking machines, dry spring grinders, and up-to-date heat treating furnaces.

★ ★ ★

New Technical Bulletin On "Mylar"

A new technical bulletin containing up-to-date information on the physical, electrical, and chemical properties of "Mylar" polyester film, and suggested applications, has been issued by the Du Pont Film Department.

★ ★ ★

First of a series to be issued on "Mylar", the new bulletin (#1-2-53) runs 14 pages, complete with charts, diagrams, and tables. "Mylar", one of the newest products of Du Pont research, is now being produced only in limited quantities for market development purposes.

★ ★ ★

In addition to a detailed table on the physical properties of "Mylar", the bulletin compares these properties with those of other Du Pont films—cellophane, polyethylene, and acetate. One section gives complete information on the film's electrical properties: dielectric strength, insulation resistance, volume and surface resistivity, etc. The chemical properties section shows the tensile strength and tear resistance of "Mylar" upon exposure to solvents, acids, and other chemical reagents.

★ ★ ★

Among its applications, it may be used as a dielectric in capacitors; slot liner and phase insulation in motors; tape insulation for motor and generator field coils; insulation for round and rectangular magnet wire; layer insulation, and insulation between turns in transformer coils; backing for

STANNOUS SULFATE

Saves Tin!

in liquor finishing operations

because

M & T Stannous Sulfate — a manufactured chemical— saves tin by doing away with many of the inefficiencies which accompany the treating of feather or flake tin to produce stannous sulfate on the job.

More convenient to use, too!

Baths are operable as soon as materials are dissolved. Solutions can be prepared in advance to produce desired colors and coating thicknesses.

AND, additions are made from stock solutions, assuring quick, complete mixing—eliminating any possibility of materials only partially dissolving in the bath—reducing the chances of miscalculating quantities of materials added.

Use M & T Stannous Sulfate for white or straw-color finishes. Write for technical procedure sheet.

METAL & THERMIT CORPORATION
Chemical Division
100 E. 42nd St., New York 17, N. Y.
Specialists in Tin and Tin Chemicals

BUNCHING
(TWISTING)
AND
STRANDING
IN THE WIRE AND
GENERAL MANUFACTURING
PROCESSES

SPECIALIZED
ENGINEERING
AND
SPECIALIZED
FACILITIES
AT YOUR SERVICE

Expanding application of twisting principles to the production of many products is reflected by an ever-increasing demand for both H-D standard equipment as well as machines especially engineered to solve varied production problems. Week after week surprising new uses are developed through the close cooperation of our engineering department with manufacturers in many fields.

Write today for our New Technical Bulletins. Tell us what you make—or contemplate making and your inquiry will receive prompt attention.

HASKELL-DAWES
MACHINE CO., INC.
2231 E. ONTARIO ST.
PHILADELPHIA 34
PA.

mica splittings, and integrated mica.

★ ★ ★

Copies of the new technical bulletin on "Mylar" (#1-2-53) may be obtained from the Du Pont Film Department's Sales Development and Technical Service Section, Wilmington 98, Delaware.

★ ★ ★

Offers Service on Small Precision Metal Jobs

Producers in the electronics and small instrument fields should be pleased to learn that the metallurgical section at **Hamilton Watch Company,** Lancaster, Penna., is prepared to supply a unique and badly needed service not to be found in normal capacity mills.

★ ★ ★

During the past fifteen years, Hamilton has assembled under one roof, the complete facilities of a miniature precision metals processing mill in which it has developed and manufactured its own alloys from which it then has made its own hairsprings, mainsprings and other small parts. These unusual facilities include induction heating furnaces, hot and cold rolling mills including a Sendzimer mill for cold rolling very hard alloys, a slitting mill and wire drawing and straightening equipment.

★ ★ ★

The total capacity of this quarter-of-a-million dollar installation exceeds the company's present combined needs for its normal product and its many defense contract assignments in the small precision instrument field. A number of companies in the electronics field have already availed themselves of this service.

★ ★ ★

Ingots of from 2 to 25 pounds can be melted into closely controlled compositions in the small induction heating furnaces. These alloys can then be forged and rolled on equipment specially designed to hold work to precise dimensions, like strip of .001 inch thickness to a tolerance of .0001 inch in widths of from 2 to 4 inches. Precision splitting mills

BETTER WORKING CONDITIONS
FASTER BUTT WELDING
FASTER ACID NEUTRALIZING
LONGER STORAGE SAFETY
YOU GET THEM ALL WITH
BORAX 5 MOL.
RUST INHIBITOR COATING
LONGER DIE LIFE
...and ONE DIP is all that is necessary for coating steel rods

BORAX 5 MOL offers worthwhile advantages over regular borax as a satisfactory coating material on ferrous rods and wire in preparation for dry drawing. This newer material offers a higher concentration of sodium borate and therefore savings may be realized through reduced transportation, handling, and storage costs. Only about three-fourths as much Borax 5 Mol need be used to equal regular borax... yet you get the same worthwhile results!

WRITE FOR YOUR COPY OF NEW SERVICE BULLETIN

PACIFIC COAST BORAX CO.
DIVISION OF BORAX CONSOLIDATED, LIMITED
NEW YORK • CHICAGO
LOS ANGELES • CLEVELAND
PHILADELPHIA

MANUFACTURERS OF FAMOUS "20 MULE TEAM" PACKAGE PRODUCTS

MASON SPOOLS SAVE YOU MONEY!

And here's why . . .

Mason spools save you money because they meet all your requirements—yet cost you less!

It's as simple as that! Mason's integrated production facilities keep costs down—and the savings are passed on to you. Mason's own coating and lithographing department offers you faster service.

Take advantage of Mason's high-quality — low-price policy now.

Write for further information or for a specific quotation.

MASON CAN COMPANY
1949 Dexter Rd., East Providence 14, R. I.
MASON CAN COMPANY OF OHIO
Greenville, Ohio

can reduce this strip to any desired smaller widths. Wire drawing equipment is capable of drawing 20 miles of hairspring wire from metal forged from a 5 pound ingot constant to tolerances of plus or minus two hundred thousandths of an inch—an accuracy impossible to obtain from normal mills.

★ ★ ★

Hamilton will entertain inquiries from a limited number of interested parties for any or all of the services outlined above—either on the basis of quoting on finished products or for the time involved in precision processing metals, strip or wire furnished. Address inquiries to Precision Services Division, Box 110, Hamilton Watch Company, Lancaster, Penna.

Ductile Iron Production Increased

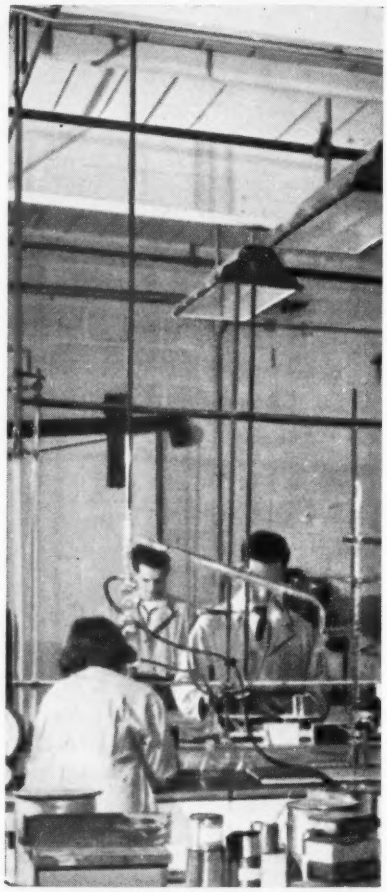
It is estimated that the production of Ductile Iron reached between 80,000 and 100,000 melt tons in 1952—an increase of 50 to 100 per cent over 1951. This new engineering material, which was developed at the Bayonne, N. J., Research Laboratory of the International Nickel Company and first commercially produced in 1949, is a cast iron which will bend or deform, under overloads, rather than failing in brittle fashion, as does ordinary cast iron.

★ ★ ★

This issue also carries a detailed review of Reynolds new 148-page technical manual, "FORMING ALUMINUM," now being made available without charge to workers, designers, engineers, and executives who request it on their company letterhead. Write to Reynolds Metals Company, 2500 South Third Street, Louisville 1, Kentucky.

Industrial Uses of Nickel-Plating Advance

Industrial uses of nickel-plating authorized under direct defense and defense-supporting applications advanced during 1952 due to the expanded use of heavy nickel protective coatings in place of solid and clad nickel.



RESEARCH FOR YOU- AT OUR EXPENSE!

Your cable coating problems can only be solved by adequate laboratory research.

Realizing this fact, we regularly allocate six cents out of every sales dollar for lacquer research activities. This progressive research policy enables us to formulate modern, improved coatings designed to meet the newest of present-day specifications.

Are you currently faced with a cable coating problem? If so, we'd appreciate the opportunity to help. Write today!

The above photograph is one of many contained in an eight-page brochure describing our facilities to serve you. Write for your copy of the complete brochure!

NEW ENGLAND LACQUER CO.
150 KING PHILIP ROAD
EAST PROVIDENCE, R. I.

THE 1953 EDITION OF THE WIRE & WIRE PRODUCTS BUYERS' GUIDE

is NOW on Sale

★

There are many hundreds of corrections and additions—a completely revised book carrying over 30,000 listings of manufacturers of rods, wire, wire products, machinery, equipment and supplies used in our industry.

★

If you are not a member of The Wire Association, place your order now for this highly useful reference book showing sources of supply.

★

Price: $5.00 each. Subscribers get a 40% discount.

WIRE & WIRE PRODUCTS

453 Main St., Stamford, Conn.

Handy Reference for Defense Plants

Plant men concerned with defense production will find the recently revised booklet, "Houghton Products Meeting Government Specifications" a helpful reference in the manufacture of items to Federal requirements.

★ ★ ★

Houghton products meeting various specifications are conveniently listed under the following classifications: rust preventives, lubricants, cutting oils, metal working aids, and leather and synthetic rubber products.

★ ★ ★

One section of the booklet of unusual interest is the Government Preservative Compound Chart, based on MIL-P-116 A, which contains descriptive and application details of P-1 to P-17 preservatives.

★ ★ ★

Distribution of the new booklet is limited to defense plants and various federal agencies, which can obtain copies from **E. F. Houghton & Co.**, 303 W. Lehigh Avenue, Philadelphia 33, Pa.

New Conduit Gets Underwriters' Approval

"Sealtite" Flexible Electrical Conduct Type UA is the first of its kind to gain Underwriters' Laboratories approval for use in wet locations. This liquid-tight flexible metal conduit is manufactured by The American Brass Company of Waterbury, Conn., who in 1947 developed the JIC-approved Sealtite Designated as Type EF, now widely used by the automotive and machine tool industries.

★ ★ ★

The tough, extruded synthetic covering over Sealtite Type UA's flexible metal core protects wiring against moisture, oil, dirt, chemicals, and corrosive fumes—on permanent and temporary installations. The conduit is made of spirally wound, interlocked zinc-plated steel strip with a copper bonding conductors wound spirally in the space between each convolution on

The TOP DIAMOND DIES are made by PHILIPS

For your most exacting wire drawing requirements, standardize on NORELCO Diamond Dies, made by the master craftsmen of PHILIPS in the world's largest, most modern diamond die factory.

Only the very best South African and Brazilian diamonds are used. Each consists of one closed crystal. Less than .4% of all the diamonds mined meet PHILIPS high quality requirements for purity, structure and shape.

These diamonds are drilled to precision tolerances, varying in proportion to the diameter, normally 0.3 to 3.5 microns. Closer tolerances can be supplied, if required.

Let us quote on your diamond die requirements.

North American Philips Company, Inc.
100 East 42nd Street, New York 17, N. Y.

Norelco

Note below the highly polished precision shaped drawing channel of this die for drawing copper which gives a burnished finish to the wire and long life to the die.

Investigate the complete line of world-famed Apco Mossberg Steel Reels, Spools and Bobbins today! Profit from a half-century of Apco experience and technical skill in providing copper wire, steel wire and wire rope manufacturers with the best in steel reels, spools and bobbins . . . in all sizes and shapes . . . for every application. Write today for complete details . . . get your free copy of the Apco Mossberg Steel Reel Booklet.

Pacific Coast Representative
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Matson Bldg., 215 Market St.
San Francisco 5, Cal.

Canadian Representative
Hugh P. Williams & Co.
47 Colborne St., West
Toronto, Ont., Canada

APCO MOSSBERG CO.

(The original Frank Mossberg Co.)
ATTLEBORO, MASS.

the inside of the conduit.

★ ★ ★

Light and flexible, Sealtite Type UA can be cut to required lengths —bends easily. Underwriters' Approved fittings for use with Sealtite Type UA are readily available. Where space is cramped and hard to get at, Sealtite Type UA is easy to install. Applications of this moisture-proof conduit are suggested to overcome the problems of movement, vibration, misalignment—both indoors and outdoors.

★ ★ ★

Sealtite UA is available in long lengths in nominal electrical ID sizes 3/8" to 1¼" inclusive.

Division Lead Buys Eagle-Picher's Metallic Products Division

Joe A. Stone, Executive Partner of the **Division Lead Company,** 836 W. Kinzie St., Chicago, has announced their purchase of the Eagle-Picher Company's Metallic Products Division plant at Argo, Ill.

★ ★ ★

Equipment and personnel of the Metallic Products Division will be retained and immediately absorbed into the combined operation.

★ ★ ★

Division Lead's present plant—two buildings extending along W. Kinzie St.—is scheduled to become primarily a distribution center, with portions of the space given over to increased industrial research. Most other phases of work will be transferred to Argo, department by department, during 1953. Additional space now available at Argo is estimated at 100,000 square feet.

★ ★ ★

It is Division's plan to enlarge their line of lead products and industrial chemicals and take on additional personnel. It is expected that production will be quadrupled within the next two years.

★ ★ ★

Division Lead's West Coast sales representative is Standard Wire and Cable Company, 3440 Overland Ave., Los Angeles; its New

Save up to ½* of your labor costs on Finishing and Lapping Tungsten Carbide Dies with a New Type 'M' DYKREX Finishing and Polishing Machine

* Statement from actual user by one of America's largest Tungsten Carbide Die Makers.

DYKREX
"IT CORRECTS THE DIE"

Write for full information
ROOS TOOL & MFG. DIVISION
DYKREX CORPORATION OF AMERICA
33-35 Bloomfield Ave., Newark 4, N. J.

York representative is the Kenneth E. Hughes Company, 17. W. 60th St., New York.

New Steel Shot Plant

American Wheelabrator & Equipment Corp., Mishawaka, Indiana, has just completed construction of a new plant specially designed for the manufacture of "WHEELABRATOR STEEL SHOT," a new blast cleaning abrasive produced under the Company's patented process.

★ ★ ★

The plant, which is now in operation, is the largest of its kind in the world. It is completely mechanized and is equipped with electric melting furnaces and automatically controlled heat treating equipment to assure constant uniformity of product.

★ ★ ★

The abrasive, invented and developed by this concern, is a carbon tool steel which is the result of experience acquired in more than 4 years of field testing. It offers increased economies in metal cleaning operations by reducing consumption, reducing equipment maintenance, and increasing cleaning efficiency.

New Gold Finish for Aluminum

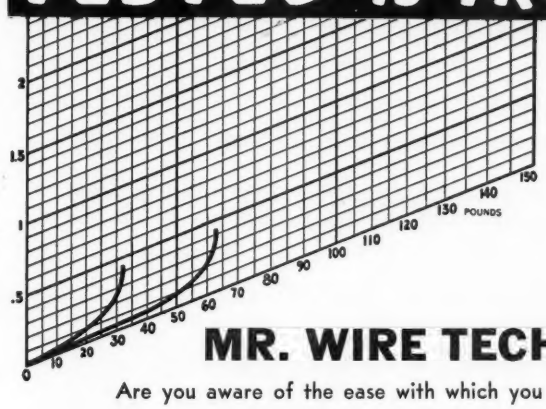
Possibilities for many new uses for aluminum have opened up with recent introduction of a new process called "D'orium" by Miracle Finishes, Inc., 10 Water St., Brooklyn 1, New York.

D'orium, licensed to Miracle Finishes, Inc., exclusively in the United States by Coloral, S. A. of Switzerland, gives aluminum a long lasting gold finish which is so realistic that it is almost impossible to detect the difference by eye alone between it and genuine gold. Six shades of gold can be achieved, as well as many other colors, all of which have a high lustre and are non-corrosive. The finish will not tarnish or discolor and since it is an integral part of the metal itself it can't chip, peel or crack.

★ ★ ★

The cost is low, as no gold is

TESTED IS TRUSTED



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Are you aware of the ease with which you can obtain "picturized" test results enabling you to evaluate wires at a glance? Scott Testers* have proven to be an invaluable aid in establishing optimum standards for materials and production, and in controlling these elements for maximum uniformity.

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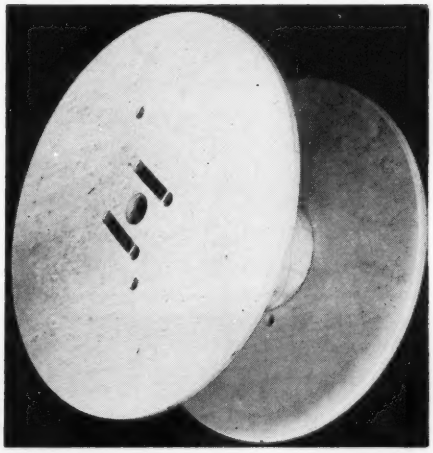
SCOTT TESTERS, INC. 55 Blackstone St. Providence, R. I.

Scott Testers — Standard of the World

FINE PLYWOOD REELS

FOR WIRE



Made of air-dried wood, all parts secured with metal strapping. This reel is durable and strong. Heads cannot be dislodged by heavy side load pressures.

Reels shipped knocked down or assembled — metal strapping easily applied by standard metal fastening clips used for boxes, etc.

Heads have accurately fitted dovetail joints that give the reel extreme rigidity. Returnable and non-returnable types, made in head diameters of 6 in. to 22 in.

Shipped to any point in New England by truck

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PLYWOOD REELS and SPOOLS

Engineered to Your Particular Requirements

Manufacturers and designers of all types plywood reels and spools for *insulated wire, bare wire, rope and cable.* Used by leading manufacturers. Prompt quotations.

CARRIS REELS, INC.

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RUTLAND, VERMONT

***Buy the Best:* MONTGOMERY SILVER-COATED COPPER WIRE**

Round—Hard or Annealed on Spools. Plain or Stranded for HOOKUP and UHF CABLES.

Flat—For Tinsel Ribbons and Tinsel Garlands.

ALSO

Bare Electric Tinsel Conductors for Telephone-Razor-Hearing Aid Cords.

WRITE FOR DETAILS

Send for samples and engineering data.

THE MONTGOMERY COMPANY

25 Canal St., Windsor Locks, Conn. Tel.: 2-3338

REELS SPOOLS

ALL SIZES

WOOD - PLYWOOD - WOOD - METAL

RETURNABLE NON-RETURNABLE

Samples and Prices on Request

DURKEE MFG. CO. PINE RIVER, MINN.

WE BUY WE SELL

We Pay Highest Prices for Used Machinery

10 NEW ENGLAND BUTT No. 15A TWINNERS — Complete

7 0 WATERBURY-FARRELL 7-Die Rod Wire Drawing Machines

5 12-WIRE 24" Reel TAKEUP STANDS

All Machines Reconditioned in Our Own Shop

WIRE & TEXTILE MACHINERY INC.

P. O. BOX 436, PAWTUCKET, R. I.

used. Further information on D'orium can be obtained by writing to Miracle Finishes, Inc.

Booklet on "Formbrite"

A 12-page booklet on "Formbrite," has been released by **The American Brass Company,** the manufacturers. "Formbrite" is metal which is stronger, harder and springier than the usual drawing brasses, yet retains remarkable ductility for forming and drawing and takes sharp, clean-cut ornamental die impressions. It is said to have a surface superior to ordinary drawing brass and was developed for applications where the metal is to be formed or drawn into products on which finishing is an important cost factor.

★ ★ ★

The publication lists "Formbrite" physical properties, and contains helpful information on press-room and finishing room procedures. Case histories of this relatively new metal are reported to show how applications of "Formbrite" have contributed to better finished products at lower production costs. Available without charge from The American Brass Company, Waterbury 20, Conn. Ask for Publication B-39.

U. S. Rubber Plans New Research Center

United States Rubber Company has signed a conditional purchase contract for approximately 80 acres of land in Emerson, New Jersey, on which it plans to create a new research center devoted to basic research in the fields of rubber, chemicals, synthetics, textiles, and plastics, it was announced yesterday by company officials.

★ ★ ★

U. S. Rubber's new research center will be about 12 miles from the existing General Laboratories at Passaic, which will continue in operation. The Passaic laboratories, with an area of about 60,000 square feet, now have a staff of 310. This is about three times the size of the staff when the laboratories were opened there in 1928. Before that, the Company's first central laboratory was located in New York City, starting in 1913.

New Booklet on Plastics

New information about the properties, applications and methods of fabricating Bakelite polyethylene plastic is set forth in a revised 24-page booklet published by **Bakelite Company,** a Division of Union Carbide and Carbon Corporation.

★ ★ ★

The revised booklet, "Bakelite Polyethylene," emphasizes with photographs and data the greatly increased use of polyethylene for producing pipe for water service, wiring conduit, mine and other products.

★ ★ ★

Seven other data tables of interest to fabricators and users of Bakelite polyethylene tabulate the average properties of molding and electrical compounds; polyethylene resin compatibility; chemical resistance and swelling properties; and the shelf life of California iceberg lettuce packaged in film of polyethylene and other materials.

★ ★ ★

Properties of Bakelite polyethylene are described in detail, as are methods of fabrication—extrusion, calendering, molding, casting and coatings. The booklet is illustrated and copies may be obtained by writing to Bakelite Company, Division of Union Carbide and Carbon Corporation, 300 Madison Avenue, New York 17, N. Y.

New Process Salvages Waste Pickle Liquors

A new waste pickle liquor recovery process was described at a meeting of prominent steel industry men held recently at **Blaw-Knox Company's** Chemical Plants Division.

★ ★ ★

Invented by Dr. Othmar Ruthner of Vienna, the new process has been improved and adapted to American engineering standards by Blaw-Knox. Dr. Ruthner was present at the recent meeting to take part in the explanation and discussion of the process.

★ ★ ★

With the large quantities of pickle liquor used in the steel in-

THE MAN who is "YOUR WIRE SUPPLIER"

WIRE STRAIGHTENED AND CUT TO LENGTH

From 16 gauge up to 5/8" diam.
WE WILL FURNISH THE WIRE or STRAIGHTEN and CUT YOUR STOCK.
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MUSIC WIRE and SPECIAL WIRES
Music Wire for Industrial Purposes
211 sizes Bright Polished, .0015" to .3125"
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Aluminum—Annealed—Belt Lacing—Brass, Soft and Spring—Copper, Bare and Tinned
Coppered Steel Spring—Galvanized—Tinned
Monel—Nickel Silver—Pure Soft Nickel—Oil Tempered, Steel Spring, Black Finish
Phosphor Bronze, Spring Temper—Pure Iron Wire—Resistance Wire,
Hoskins Chromel "A"—Stainless, Soft and Spring Temper—Tag Wire, 1000
in an Envelope—Florist Wire—Spooled and Coiled, 1/4-1/2-1-5#
Wires Straightened and Cut to length—Small Gauges—Small orders our specialty
Wires and Strands for the fishermen. Trolling Wires, Copper-Monel-Stainless.
Leader Wires, "Wilstabrite" Stainless and "Silverbrite" Music.

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2514 Vestry Ave. Established in 1884 Cleveland 13, Ohio

MILTON MACHINE
RUGGED in design... DEPENDABLE in service!

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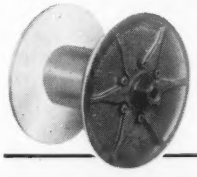

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dustry (estimated at more than 600 million gallons a year), the problem of disposing of this waste has become increasingly difficult and costly. For public health reasons, state governments forbid emptying waste pickle liquor into the streams.

★ ★ ★

The company will be glad to furnish additional information upon request.

Torrington Mfg. Co. Expands Facilities

The Torrington Manufacturing Company has formerly announced the opening of a major addition to its manufacturing facilities. **S. W. Farnsworth,** president, in commenting on the latest development phase, stated that the firm during the past year has also expanded its facilities of its subsidiaries in Los Angeles, Calif. and Oakville, Ont. He attributes the increased demand for the company's products to America's continually rising standard of living.

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Drawalloy Corporation Moves to New Quarters, Expands Its Operations

The Drawalloy Corporation, a wire mill producing stainless and tool steel wire for the welding industry, has expanded its operations and manufacturing facilities with new and enlarged quarters on Lincoln Highway West at Alloy Street, York, Pennsylvania, accord to E. J. Brady, president.

★ ★ ★

This wire mill was established exclusively for the production of stainless steel, tool steel, and special alloy wire for the welding industry, including coiled stainless wire for all types of automatic welding.

★ ★ ★

Large inventories of hot rolled rod and in-process wire of the special chemical analyses required for welding are maintained. Finished stocks of cut wire for gas and inert arc welding are maintained in all grades of stainless

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wire and the five common types of tool steel: water hardening, oil hardening, air hardening, hot work, and high speed.

★ ★ ★

Drawalloy Corporation has introduced a new form of package protection for its products, designed to simplify handling and shelving problems of both jobber and ultimate consumer. Ten pounds of bare wire in cut lengths are packed in clearly marked, sturdy fiber tubes with removable and replaceable caps. Six of these tubes are packed in corrugated shipping cartons.

★ ★ ★

Mr. Brady, president of Drawalloy, is also founder and president of the Alloy Rods Company, York, Pennsylvania, leading manufacturer of alloy arc welding electrodes.

★ ★ ★

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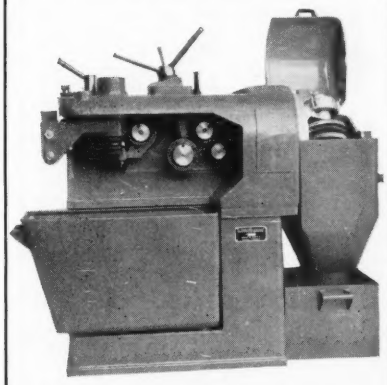

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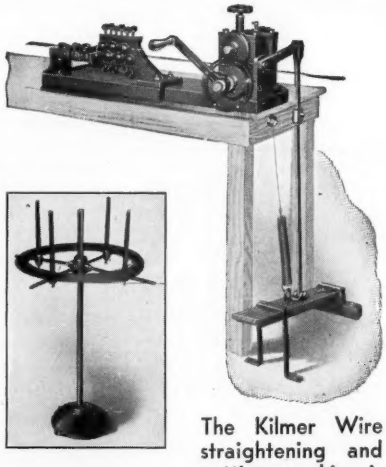

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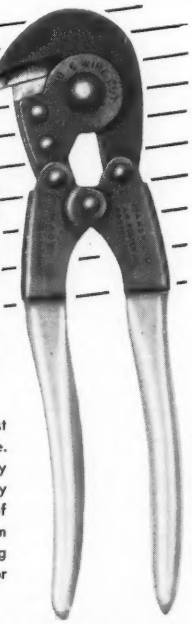

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Grits and Grinds

GRITS and GRINDS, Volume 43, No. 12, has been published by the Technical Service Section of the Norton Company, Worcester, Mass. It is a special issue devoted entirely to the related subjects of carbide tool grinding and diamond wheel conservation.

★ ★ ★

Important and timely, the issue contains three articles: "'Micro-Finishing' Carbide Tools" (a new abrasive belt method); "Silicon Carbide Wheels" (for grinding carbide tools); and "Grinding Carbide Tools with Electrolytically-Assisted Diamond Wheels."

★ ★ ★

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carbide tools, all big production jobs will have to be tooled for carbides within five years in order to meet competition. With this prospect, the continuing need for conserving the limited supply of diamond bort available for the manufacturer of diamond wheels is obvious.

★ ★ ★

The three technical articles in this issue present the very latest experiences and recommendations from Norton Company's research laboratories and Sales Engineering department, as well as those of their associate, Behr-Manning Corporation, on sharpening carbide tools.

★ ★ ★

You are invited to send for a copy of the issue.

New Bulletin on Chains

A new bulletin on Rex Steel Detachable Chain has just been published by Chain Belt Company of Milwaukee.

★ ★ ★

The new bulletin is handbook size. It explains the step by step manufacture of Rex Steel Detachable Chain. Plain chain and attachments are illustrated and described. Tables giving dimensions, weight, prices, strengths, lengths, etc., are included. Interesting steel detachable chain drive and conveyor applications are illustrated. Of much value to designers are the sections of the book devoted to chain theory, chain travel, recommendations for drives and conveyors, sprocket theory and sprocket design.

★ ★ ★

Chain Belt Company is one of the leading manufacturers of sprocket chains and power transmission machinery; conveyors and process equipment; and construction machinery.

Heads New Department in G-E's Bridgeport Plant

Maurice W. Reid, works manager of **General Electric's Bridgeport plant** since 1948, has been appointed manager of the newly organized employe and plant community relations department. The

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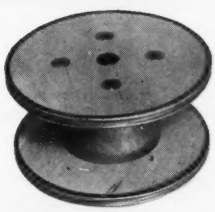
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title of works manager has been officially abolished.

★ ★ ★

Four other appointments have been made public by **Clarence C. Walker,** G-E vice president and general manager of the construction materials division. They are: **John Waddell,** manager employee relations; **F. Joseph Finsinger,** manager of education and training; **Kenneth A. Maloney,** manager, plant community relations and **William F. Burleigh,** manager, union relations and wage rate.

★ ★ ★

Mr. Reid joined General Electric Company at Lynn, Mass., in 1921 and was assigned as assistant superintendent in the general tool section of the Bridgeport plant in 1936. He was later named superintendent. In 1946 he was appointed assistant works manager and in 1948 works manager.

Sheet and Tube Transfers

Frank C. Sterling has been transferred by **The Youngstown Sheet and Tube Company** from its Yoloy sales office in Youngstown to its district sales office in Pittsburgh, Pa.

★ ★ ★

Mr. Sterling, a native of Youngstown, attended Rayen School in Youngstown, Ohio State University in Columbus and Youngstown College, specializing in engineering and business administration. He joined The Youngstown Sheet and Tube Company as a hall boy. He advanced to the Pricing Department, Flat Rolled Sales and Yoloy sales.

Phelps Dodge Opens Milwaukee Office

S. Allan Jacobs, vice president of **Phelps Dodge Copper Products Corporation,** announces the opening of district sales offices at 2408 North Farwell Avenue, Milwaukee 11, Wisconsin. **Lewis E. Pilsbury,** formerly with Chase Brass and Copper Company, will be resident manager of the office. A graduate of the Babson Institute of Business Administration, Mr. Pilsbury has been in the copper fabricating industry since his return from naval service in 1947.

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James R. Thompson

James R. Thompson, formerly Manager of the Metallurgical Department of **American Steel and Wire** in Cleveland, died suddenly on Saturday, April 25, 1953. Funeral services were conducted at the Fairmount Presbyterian Church, followed by interment at the Knollwood Cemetery.

★ ★ ★

Mr. Thompson, after fifty years of service with American Steel and Wire, retired on November 30, 1951, following which he became associated with Lamson and Sessions Company on metallurgical problems. He had been a member of The Wire Association and was one of its directors at the time of his retirement. He had served as chairman of the Rod and Wire Committee of the American Iron and Steel Institute.

Introduces New Die and Reduces Prices

The Carboloy Department of General Electric Company, Detroit 32, Michigan, has announced the addition of a new die for fine wire drawing. The new die, designated R-O, is priced economically to avoid "build-up" and can be disposed of after becoming worn without creating uneconomical inventory problems.

★ ★ ★

At the same time the company has announced reductions in price on a major portion of its standard line. Most sizes were reduced by 10%, but on some sizes there is an even greater reduction, running to 25 per cent on the rough cored R-1.

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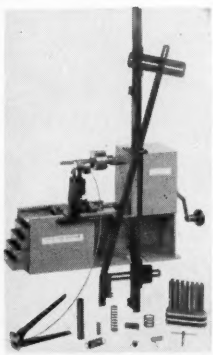
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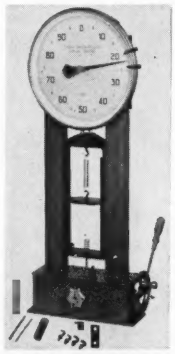
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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.
Only advertisers who have contracted for six or more insertions are listed in this section.

ABRASIVES—
Elgin National Watch Co., Abrasive Div., Elgin, Ill.
Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Ceilcote Company, Cleveland, Ohio
Chemical Construction Co., Pittsburgh, Pa.
Haveg Corporation, Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.
Trauwood Engr. Co., Cleveland. O

ANNEALING POTS AND BOXES—
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

BAKERS—(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

BORAX—Wire Drawing
Pacific Coast Borax Co., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Providence, R. I.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CARTONS—Paper
(See CONTAINERS—Paper, for nails, etc.)

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Acid Proof
Ceilcote Company, Cleveland, Ohio

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Metal & Thermit Corp., New York, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago.

CLEANING & PICKLING EQUIP.—
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corporation, Newark, Del.
Holden, A. F., Company, The, Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

CLOTH—WIRE, All Metals
Chase Brass & Copper Co., Waterbury, Conn.
Roebling, John A. Sons Corp., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Chicago.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Techema Co., Buffalo, N. Y.

COMPOUNDS—Diamond (Pre-Mixed)
Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago.

COMPOUNDS—Extrusion, for Wire
(See Compounds—Vinyl)

COMPOUNDS—For Improving Drawing and Extrusion
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Phosphate Coating
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago.

COMPOUNDS—Vinyl, for Wire
Electronic Rubber Co., Stamford, Conn.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Pacific Coast Borax Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Mach'y, Inc. (used) Pawtucket. R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVE PAPERS—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Dept. of General Electric Co., Detroit.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Manco Manufacturing Co., Bradley, Ill.
Porter, H. K. Inc., Somerville, Mass.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
American Coldset Corp., Paterson, N. J.
Danforth, The C. W. Co., Youngstown, Ohio
Elgin National Watch Co., Abrasive Div., Elgin. Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
Industrial Diamond Powders, New Kensington, Pa.
National Research Company, St. Claire Shores, Mich.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDER RECLAIMING—
Boulin, Victor J., Inc., New York, N. Y.
Danforth, The C. W. Co., Youngstown, Ohio
Industrial Diamond Powders, Inc., New Kensington, Pa.
National Research Co., St. Claire Shores, Mich.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DIAMOND TOOLS—
Carboloy Dept. of General Electric Co., Detroit.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Roux Wire Die Works, Inc., Oriskany, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide, Tungsten & Tantalum
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Metal Carbides Corporation, Youngstown, Ohio
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Eastern Carbide Corp., Now Rochelle, N. Y.
Kelly Wire Die Corp., New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc, New York, N. Y.
Carboloy Dept. of General Electric Co., Detroit.
Cochaud Wire Die Corp., New York, N. Y.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Ft. Wayne Wire Die., Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York.
Rayaloy Carbide Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Universal Wire Die Co., Cranford, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Murex, Ltd., Rainham, England
Rayaloy Carbide Corp., New York, N. Y.

DIES—Swaging
Murex, Ltd., Rainham, England
Royaloy Carbide Corp., New York
Sjogren Tool and Mach. Co., Inc., Auburn, Mass.

DIES—Tube Drawing
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Dept. of General Electric Co., Detroit.
Continental Carbide Die Co., Lyndhurst, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth Sterling, Inc., Pittsburgh, Pa.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Murex, Ltd., Rainham, England
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS & TRAVERSES—Flange Steel
Entwistle, Jas. L. Co., Providence, R. I.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

DRYING EQUIPMENT
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Rockwell, W. S. Co., Fairfield, Conn.

ENGINEERS—Consulting
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.
Wire Insulating and Rubber and Plastics Processing—Hale and Kullgren, Inc., Akron, Ohio
Zinc—Imhoff, Wallace G., Co., No. Highlands, Calif.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Harper Electric Furnace Corp., Buffalo, N. Y.
Rockwell, W. S. Co., Fairfield, Conn.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F. Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Morrison Industries, Bedford, Ohio
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Trauwood Engr. Co., Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, Detroit, Mich.
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

FURNACES—Resistance Heating, Strand
(See Annealing Machines)

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio
Holden, A. F., Co., The, Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

GALVANIZING EQUIPMENT — (See MACHINERY—Galvanizing Wire)

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

GUIDES—for Wire
Heany Industrial Ceramic Corp., New Haven Conn.

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

IMPREGNATING MATERIALS—
Solar Compounds Corporation, Linden, N. J.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INSULATING MATERIALS—
Belding Hemingway, New York, N. Y.
Electronic Rubber Co., Stamford, Conn.
Glass Fibers, Inc., Toledo
Heineman Corp., Oscar, Chicago, Ill.
Merrimac Paper Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

INSULATING MATERIALS — Paper—For Electric Wire Cable
Merrimac Paper Co., New York, N. Y.
Solar Compounds Corporation, Linden, N. J.
Solar Varnish Corp., Linden, N. J.

LACQUERING SYSTEMS — See MACH.—Lacquering Electric Wire

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Solar Compounds Corporation, Linden, N. J.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison, N. J.
Standard Industrial Compounds Co., Chicago.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, Carload shipments for lagging and car blocking
Canada Reels, Ltd., Bury, Que., Canada
North Anson Reel Co., No. Anson, Me.

MACHINERY—Armoring (Cable, Wire, Hose)
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Bolts & Rivets
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany

MACHINERY—Braiding
Fidelity Machine Co., Inc., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bunching
Cook Manufacturing Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Inc., Philadelphia, Pa.
Haskell-Dawes Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Machinery—Winding Wire)

MACHINERY—Chain Making
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Nilson, A. H. Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Closing Rope
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Vaughn Mach'y Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Cold Heading
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Copper Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh.
American Insulating Mach'y Co., Phila., Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Mach'y Exch. (Used), New York.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Manco Manufacturing Co., Bradley, Ill.
Mettler Machine Tool, Inc., New Haven, Conn.
Porter, H. K., Inc., Somerville, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Descaling Rod, Dry
Fisher Associates, New York, N. Y.

MACHINERY—Die Making
American Optical Co., Instrument Div., Buffalo, N. Y.
Boulin, Victor J., Inc., New York, N. Y.
Carboloy Dept. General Electric Co., Detroit, Mich.
Firth Sterling, Inc., Pittsburgh, Pa.
Kelly Wire Die Corp., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wartenweiler, Emilio, Milano, Italy

MACHINERY—Edging (See MACHINERY — Tandem Rolling and Edging Mills)

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Industrial Ovens, Inc., Cleveland, Ohio

MACHINERY—Extruding
Aetna-Standard Engineering Co., Pittsburgh.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Mettler Machine Tool, Inc., New Haven, Conn.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp. Cleveland, Ohio

MACHINERY—Forming Wire
Baird Machine Co., Stratford, Conn.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating Wire
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
Fidelity Machine Co., Inc., Philadelphia, Pa.
Hale and Kullgren, Inc., Akron, Ohio
National Rubber Machinery Co., Akron, Ohio
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Mach. Co., Central Falls, R.I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Inc., Philadelphia, Pa.

MACHINERY—Lacquering Electric Wire
American Insulating Mach'y Co., Philadelphia.
Industrial Ovens, Inc., Cleveland, O.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Baird Machine Co., The, Stratford, Conn.
Glader, Wm., Machine Works, Chicago, Ill.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlingen 3, Wurtt., Germany

MACHINERY—Optical, for Dies
American Optical Co., Instrument Div., Buffalo, N. Y.

MACHINERY—Pickling
Chemsteel Construction Co., Pittsburgh, Pa.
Youngstown Welding & Eng'g. Co., Youngstown, Ohio

MACHINERY—Pin Making
Baird Machine Co., The, Stratford, Conn.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale and Kullgren, Inc., Akron, Ohio
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.
Malmedie Maschinenfabrik, Dusseldorf, Germany
Wean Equipment Corp., Cleveland, O.

MACHINERY—Pre-Heater for Wire (for Extrusion of Plastics)
Industrial Ovens, Inc., Cleveland, Ohio
National Rubber Machinery Co., Akron, Ohio

MACHINERY—Re-Spoolers
Boyd & Sons Manufacturing Corp., Philadelphia, Pa.
Davis Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Providence, R. I.
National Mach'y Exch. (Used), New York, N. Y.
Steel Equipment Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Inc., Manchester, Conn.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Engineering Co., Cleveland, Ohio

MACHINERY—Rubber Insulating
National Rubber Machinery Co., Akron, Ohio
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spark Testing
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Spring Making
Carlson Company, The, New York, N. Y.
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wafios, Maschinenfabrik, Reutlinger 3, Wurtt., Germany
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.
Wafios, Maschinenfabrik, Reutlinger 3, Wurtt., Germany.

MACHINERY—Straightening & Cutting
Kilmer, M. D., & Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Medart Co., The, St. Louis, Mo.
Mettler Machine Tool Co., New Haven, Conn.
Meyer, Roth & Pastor Maschinenfabrik, Koln-Raderberg, Germany
National Mach'y Exch. (Used), New York, N. Y.
Wartenweiler, Emilio, Milano, Italy
Wells, Frank L., Co., Kenosha, Wisc.

MACHINERY—Stranding
Haskell-Dawes Machine Co., Philadelphia, Pa.
Hughesville Machine & Tool Co., Hughesville, Pa.
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Take-Up and Pay-Out
Aetna-Standard Engineering Co., Pittsburgh, Pa.
American Insulating Mach'y Co., Phila., Pa.
Davis Electric Co., Wallingford, Conn.
Hale & Kullgren, Inc., Akron, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Marshall-Richards Machine Co., Inc., Trenton, N. J.
Standard Machinery Co., Mystic, Conn.
Standard Mill Supply Co., Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Ets. Pourtier Frères, Romainville, France
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

MACHINERY—Testing, Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill, Cold Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Marshall-Richards Machine Company, Inc., Trenton, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N. J.
Davis Electric Co., Wallingford, Conn.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.

MACHINERY—for Wire Welding (See WELDERS—Butt and Spot)

MACHINERY—Winding Wire
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L., Co., Providence, R. I.
New England Butt Co., Providence, R. I.
Standard Mill Supply, Pawtucket, R. I.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Cook Manufacturing Co., The, Paterson, N. J.
Hale & Kullgren, Inc., Akron, Ohio
Herborn, Herborn, Germany
Marshall-Richards Machine Co., Inc., Trenton, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Wire Forming
Baird Machine Co., The, Stratford, Conn.
Kilmer, M. D., & Co., Cleveland, Ohio
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
Milton Machine Works, Inc., Milton, Pa.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
Angier Corporation, The, Framingham, Mass.
Marshall-Richards Machine C., Inc., Trenton, N. J.
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Wean Equipment Co., Cleveland, Ohio

NAIL TOOLING—Tungsten Carbide
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio
Westinghouse Electric Corp., Industrial Heating Div., Meadville, Pa.

OVENS—Rod Bakers
Carl-Mayer Corp., The, Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio
Morrison Industries, Cleveland, Ohio

PAINT—Acid Proof
Ceilcote Company, Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PAINT BONDING CHEMICALS—
American Chemical Paint Co., Ambler, Pa.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.
Solar Compounds Corp., Linden, N. J.

PAPER—Creped Wrapping
Angier Corporation, The Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D. C.

PAY-OUT SYSTEMS—(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS — (See COMPOUNDS — Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PICKLING—Hooks, etc. Acid Resisting
Youngstown Welding & Eng'g' Co., Youngstown, Ohio

PICKLING TANK LININGS—
Chemsteel Construction Co., Pittsburgh, Pa.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio
Nukem Products Corporation, Buffalo, N. Y.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

PRESSES—Hydraulic and Mechanical
Aetna-Standard Engineering Co., Pittsburgh, Pa.
Hale & Kullgren, Inc., Akron, Ohio
Standard Machinery Co., Mystic, Conn.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N. J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio

REEL AND TENSION STANDS—
Davis Electric Co., Wallingford, Conn.
Entwistle, Jas. L. Co., Providence, R. I.
Fidelity Machine Company, Inc., Philadelphia.
Industrial Ovens, Inc., Cleveland, Ohio

WHERE TO BUY, Continued

For more complete information, consult the annual Wire and Wire Products Buyers' Guide.

Kilmer, M. D., & Co., Cleveland, Ohio
Roll-A-Reel, Cincinnati, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Mill Supply Co., Pawtucket, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire Insulating Machy., Inc., Manchester, Conn.

REEL CRUTCHES—
Roll-A-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Milton Machine Works, Inc., Milton, Pa.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Metal Bound
Canada Reels, Ltd., Bury, Que., Canada
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
McCaskie, Inc., Wm., Westport, Mass.
North Anson Reel Co., No. Anson, Me.

REELS—Plywood
Carris Reels, Inc., Rutland, Vt.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
McCaskie, Inc., Wm., Westport, Mass.
Nelson Company, The, Baltimore, Md.
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L. Mfg. Co., Rockford, Ill.
Howsam Spool Co., Aurora, Ill.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
Mason Can Company, East Providence, R. I.
Milton Machine Works, Inc., Milton, Pa.
McCaskie, Inc., Wm., Westport, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Mettler Machine Tool, Inc., New Haven, Conn.
Republic Steel Corp., Pressed Steel Div., Niles, Ohio
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Canada Reels, Ltd., Bury, Que., Canada
Carris Reels, Inc., Rutland, Vt.
Durkee Mfg. Co., Pine River Minn.
Lavendier, Charles, Co., Inc., Pawtucket, R. I.
Nelson Company, The, Baltimore, Md.
North Anson Reel Co., No. Anson, Me.
Winchester Reel Co., Ashuelot, N. H.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—(See Ovens—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Company, Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling, John A. Sons Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Co., The, Detroit, Mich.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
(See Compounds—Wire Drawing)

SODIUM—for Descaling
Holden, A. F., Co., The, Detroit, Mich.

SPOOLS—(See Reels & Spools)

SPOOLS—Stamped Metal for Retail Wire Sales
Clark, J. L. Mfg. Co., Rockford, Ill.
Mason Can Co., East Providence, R. I.

STAMPINGS—Steel
Acrometal Products, Inc., Minneapolis, Minn.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling, John A. Sons Corp., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling and Plating
Ceilcote Company, Cleveland, Ohio
Chemsteel Construction Co., Pittsburgh, Pa.
Nukem Products Corporation, Buffalo, N. Y.

TESTERS — INSULATION (See MACHINERY—Spark Testers)

TESTING EQUIPMENT (See MACHINERY Testing, Physical)

TINNING PROCESS—
Metal & Thermit Corp., New York, N. Y.

TINSEL—Electric Conductor
Montgomery Co., The Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper, Silver and False Gold Coated, etc. (See TINSEL—Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TOOLS—Wire Cutting
Porter, H. K., Inc., Somerville, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRANSMISSIONS—Variable speed (See Machy—Power Transmission)

TRAVERSES & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc. (used) Pawtucket, R. I.
Wire Insulating Machy., Inc., Manchester, Conn.

TUBE BENDERS AND FORMERS—
Kilmer, M. D., & Co., Cleveland, Ohio

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—for Electric Wire
N. E. Lacquer Co., E. Providence, R. I.
Solar Varnish Corporation, Linden, N. J.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire Insulating Machy., Inc., Manchester, Ct.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIRE—Aluminum
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.

WIRE—Barbed
Gerber, J., & Co., Inc., New York, N. Y.
Interlocking Fence Co., Morton, Ill.

WIRE—Brass
Chase Brass & Copper Co., Waterbury, Conn.
Spencer Wire Corp., Union, N. J.

WIRE—Brush
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., Inc., New York, N. Y.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Copper
Chase Brass & Copper Co., Waterbury, Conn.
Gerber, J., & Co., Inc., New York, N. Y.
Spencer Wire Corp., Union, N. J.

WIRE—Flat, Fine
Elmet Division, North American Philips Company, Inc., Lewiston, Maine
Gerber, J., & Co., Inc., New York, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Forming
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Galvanized
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Continental Steel Corp., Kokomo, Ind.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling, John A. Sons Corp., Trenton, N. J.
Seneca Wire & Manufacturing Co., Fostoria, O.
Spencer Wire Corp., Union, N. J.
U. S. Steel Co., N. Y., N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
American Steel & Wire Co., Cleveland, Ohio
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., The, Cleveland, Ohio
Seneca Wire & Manufacturing Co., Fostoria, O.
Specialty Wire Co., Inc., Worcester, Mass.
Spencer Wire Corp., Union, N. J.

WIRE—Nickel Silver and Phosphor Bronze
Chase Brass & Copper Co., Waterbury, Conn.
Malin & Co., The, Cleveland, Ohio

WIRE—Oil Tempered
Pittsburgh Steel Co., Pittsburgh, Pa.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Specialty Wire Co., Inc., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio
Firth Sterling, Inc., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Specialty Wire Co., Inc., Worcester, Mass.

WIRE—Steel—Also Coppered and Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Erie Iron & Supply Corp., Erie, Pa.
Gerber, J., & Co., New York, N. Y.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Seneca Wire & Mfg. Co., Fostoria, Ohio
Spencer Wire Corp., Union, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Erie Iron & Supply Corp., Erie, Pa.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., Allied Products Division, New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WRAPPING PAPER—Creped (See PAPER—Creped Wrapping)

YARNS & TAPES—
Belding Hemingway, New York, N. Y.
Glass Fibers, Inc., Toledo, Ohio

YARN TESTERS—
Heineman Corp., Oscar, Chicago, Ill.
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

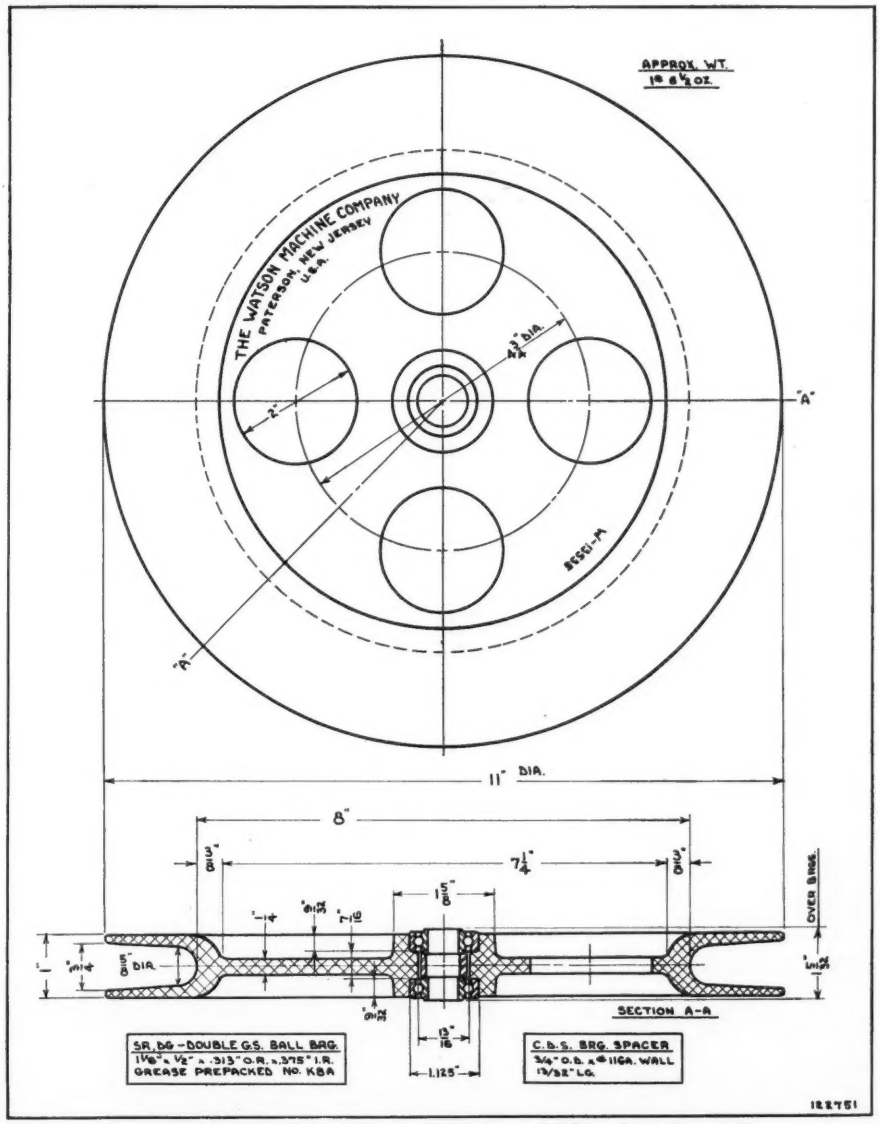
WATSON

MOLDED SHEAVES

BLACK, RED AND GREEN BAKELITE. EXCELLENT DIELECTRIC, SUITABLE FOR HIGH TEMPERATURES AND IMMERSION IN LIQUIDS. MACHINABLE FOR FLANGE HEIGHT REDUCTION, GROOVE CONTOUR CHANGE AND BRONZE BUSHING INSERTION, GREAT STRENGTH AND LIGHT WEIGHT. BALANCED FOR HIGHEST SPEEDS, BALL BEARING FIT ACCURATELY MOLDED IN. ANY COLOR IN QUANTITIES OVER 100. MANY THOUSANDS IN USE.

LOW COST

FROM STOCK



Inquiries Invited — Address "Plastics Dept."

AGING

ALUMINIZING

ANNEALING

BILLET HEATING

BRAZING

BRIGHT ANNEALING

CARBON RESTORATION

CARBURIZING

CERAMIC DECORATING

DRAWING

ENAMELING

GALVANIZING

HARDENING

HOMOGENIZING

MALLEABLIZING

NORMALIZING

NITRIDING

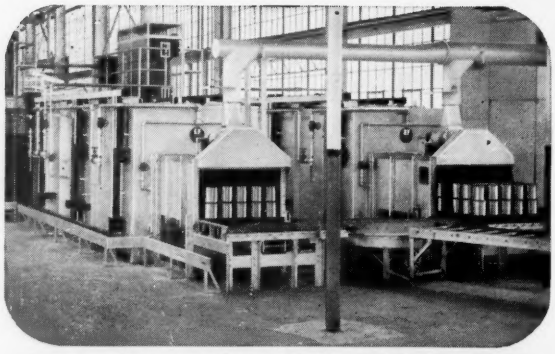
SINTERING

SOLUTION TREATING

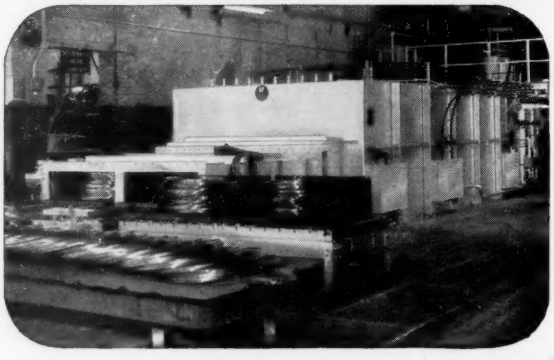
STRESS RELIEVING

STRIP—ANY PROCESS

SPECIAL ATMOSPHERE TREATMENTS AND OTHER PROCESSING



EF gas-fired and electric furnaces are built in many sizes and types for bright annealing wire on spools or reels, in coils or strands—ferrous and non-ferrous, including stainless.



An EF continuous bright annealing furnace in which the wire is conveyed through the various zones on two parallel rows of bunkhead type trays.

EF PRODUCTION FURNACES

for these and other processes

Reflecting more than 30 years of continuous research, experience and outstanding engineering accomplishments, EF production furnaces combine high heating efficiency—accurate, automatically controlled cycles—high fuel economy—and produce products with uniform physicals and surface finish, year after year.

For advanced engineering designs that minimize maintenance and produce high hourly outputs, turn your production furnace problems over to one of the experienced EF furnace engineers—It pays.

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio

Canadian Associates • CANEFCO LIMITED • Toronto 1, Canada

Clean annealing alloy wire in an EF gas-fired radiant tube continuous roller hearth furnace. Handles coils up to 30" in diameter.